

UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY

LG ELECTRONICS U.S.A., INC., LG
ELECTRONICS, INC., & LG ELECTRONICS
MONTERREY MEXICO, S.A., DE, CV,

Plaintiffs,

v.

WHIRLPOOL CORP., WHIRLPOOL
PATENTS CO., WHIRLPOOL
MANUFACTURING CORP., and MAYTAG
CORP.

Defendants.

CIVIL ACTION

Civil Action No. 2:08-cv-1869

HONORABLE JUDGE FAITH S. HOCHBERG

**DECLARATION OF
RICHARD B. HARPER
IN SUPPORT OF
DEFENDANTS' MOTION
TO TRANSFER**

Richard B. Harper declares as follows:

1. I am over the age of 18 years old and competent to testify to the matters set forth below. I am an attorney with the law firm of Baker Botts, LLP, counsel for Defendants, Whirlpool Corp., Whirlpool Patents Co., Whirlpool Manufacturing Corp., and Maytag Corp. in this action. I have personal knowledge of the facts set forth herein.

2. This declaration is for the purpose of authenticating certain documents attached hereto that are being filed by Defendants as exhibits to the Defendants' Memorandum of Law in Support of Motion to Transfer.

3. Exhibit 1 is a true and correct copy of the Complaint, without exhibits, filed by Plaintiffs in this case on April 16, 2008.

4. Exhibit 2 is a true and correct copy of the Complaint, without exhibits, filed by LG Electronics, Inc. and LG Electronics USA, Inc. in the District of Delaware on April 24, 2008.

5. Exhibit 3 is a true and correct copy of Whirlpool Corp.'s Answer and Affirmative Defenses to the Complaint and Counterclaims Thereto, without exhibits, filed by Whirlpool Corp. in the District of Delaware on May 1, 2008.

6. Exhibit 4 is a true and correct copy of U.S. Patent No. 6,082,130.

7. Exhibit 5 is a true and correct copy of U.S. Patent No. 6,810,680.

8. Exhibit 6 is a true and correct copy of U.S. Patent No. 6,915,644.

9. Exhibit 7 is a true and correct copy of U.S. Patent No. 7,316,121.

10. Exhibit 8 is a true and correct copy of U.S. Patent No. 6,834,922.

11. Exhibit 9 is a true and correct copy of U.S. Patent No. 7,147,292.

12. Exhibit 10 is a true and correct copy of U.S. Patent No. 5,269,601.

13. Exhibit 11 is a true and correct copy of U.S. Patent No. 5,269,154.

14. Exhibit 12 is a true and correct copy of U.S. Patent No. 6,991,526.

15. Exhibit 13 is a true and correct copy of U.S. Patent No. 7,293,846.

16. Exhibit 14 is a true and correct copy of a page downloaded from the website of LG Electronics on May 1, 2008.

17. Exhibit 15 is a true and correct copy of a page downloaded from the website of Finnegan Henderson Farabow Garrett & Dunner L.L.P. on May 1, 2008.

I declare under penalty of perjury that the foregoing is true and correct.

May 1, 2008

Date

By: /s/ Richard B. Harper

Richard B. Harper (RH 5979)

EXHIBIT 1

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LG ELECTRONICS U.S.A., INC.,
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LG ELECTRONICS MONTERREY
MEXICO, S.A., DE, CV

**UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY**

LG ELECTRONICS U.S.A., INC.,
LG ELECTRONICS, INC., &
LG ELECTRONICS MONTERREY
MEXICO, S.A., DE, CV,

Plaintiffs,

v.

WHIRLPOOL CORPORATION,
WHIRLPOOL PATENTS COMPANY,
WHIRLPOOL MANUFACTURING
CORPORATION, &
MAYTAG CORPORATION,

Defendants.

Civil Action No. _____

**COMPLAINT FOR
DECLARATORY JUDGMENT**

Plaintiffs LG Electronics U.S.A., Inc., LG Electronics, Inc., and LG Electronics

Monterrey Mexico, S.A., DE, CV (collectively, "LG") allege as follows for their Complaint for

Declaratory Judgment against Defendants Whirlpool Corporation, Whirlpool Patents Company, Whirlpool Manufacturing Corporation, and Maytag Corporation (collectively, "Whirlpool"):

Parties

1A. Plaintiff LG Electronics U.S.A., Inc. is a Delaware corporation having a principal place of business at 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632.

1B. Plaintiff LG Electronics, Inc. is a Korean corporation having a principal place of business at LG Twin Towers, 20 Yoido-dong, Yeongdeungpo-gu, Seoul, Korea 150-721.

1C. Plaintiff LG Electronics Monterrey Mexico, S.A., DE, CV is a Mexican corporation having a principal place of business at Av. Industrias 180, Fracc Industrial Pimsa Ote., 66603 Apodaca, Nuevo Leon, Mexico.

1D. On information and belief, Defendant Whirlpool Corporation is a Delaware corporation having a principal place of business at 2000 North M-63, Benton Harbor, Michigan 49022.

1E. On information and belief, Defendant Whirlpool Patents Company is a Michigan corporation having a principal place of business at 500 Renaissance Drive, Suite 102, St. Joseph, Michigan 49085 and is a wholly owned subsidiary of Whirlpool Corporation.

1F. On information and belief, Defendant Whirlpool Manufacturing Corporation is a Michigan corporation having a principal place of business at 500 Renaissance Drive, Suite 102, St. Joseph, Michigan 49085 and is a wholly owned subsidiary of Whirlpool Corporation.

1G. On information and belief, Defendant Maytag Corporation is a Delaware corporation having a principal place of business at 2000 North M-63, Benton Harbor, Michigan 49022 and is a wholly owned subsidiary of Whirlpool Corporation.

Jurisdiction and Venue

2. LG brings this civil action under the Patent Laws, Title 35 of the United States Code, and under 28 U.S.C. § 2201 to obtain a declaration of noninfringement and/or invalidity and/or unenforceability with respect to U.S. Patent Nos. 6,082,130, 6,810,680, 6,915,644, 6,971,730, and 7,240,980 (collectively, “the patents-in-suit” or “the asserted patents”). Since this action arises under the Patent Laws of the United States, this Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

3. Venue in this judicial district is proper under 28 U.S.C. §§ 1391(b), 1391(c) and 1400(b).

Background

4. LG hereby restates and realleges the allegations set forth in paragraphs 1 through 3 and incorporates them by reference.

5. On information and belief, Whirlpool Patents Company is the owner by assignment of U.S. Patent No. 6,082,130 and Maytag Corporation is the owner by assignment of U.S. Patent Nos. 6,810,680, 6,915,644, 6,971,730, and 7,240,980.

6. On January 23, 2008, Whirlpool filed a Complaint with the U.S. International Trade Commission (ITC) alleging that LG was engaging in unfair acts in violation of Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, through the alleged importation into the United States, the sale for importation into the United States, and/or the sale or offer for sale within the United States after importation, of refrigerators and components that were alleged to infringe the patents-in-suit. The ITC instituted the investigation on February 21, 2008, and the investigation has been captioned *In re CERTAIN REFRIGERATORS AND COMPONENTS THEREOF*, Inv. No. 337-TA-632 (ITC).

7. Whirlpool, based on its alleged assertion of infringement of the asserted patents before the ITC, is seeking a permanent exclusion order under Section 337(d) and a cease and desist order under Section 337(f)(1). LG denies that it infringes any valid and enforceable claims of the asserted patents, or that Whirlpool is entitled to any relief for the alleged infringement of the asserted patents.

8. In view of Whirlpool's Complaint against LG with the ITC and the pending ITC investigation, and in view of Whirlpool's assertions of patent infringement and requests for relief and LG's denials, an actual and justiciable controversy exists between LG and Whirlpool regarding the infringement, validity, and/or enforceability of the patents asserted in the ITC investigation, the rights of the respective parties regarding Whirlpool's allegations of infringement, and the remedies available to the respective parties regarding Whirlpool's assertion of infringement.

**First Count: Declaratory Judgment of
Noninfringement and Invalidity of U.S. Patent No. 6,082,130**

9. Plaintiffs hereby restate and reallege the allegations set forth in paragraphs 1 through 8 and incorporate them by reference.

10. On information and belief, Defendant Whirlpool Patents Company is the owner by assignment of U.S. Patent No. 6,082,130, entitled "Ice Delivery System for a Refrigerator." A copy of U.S. Patent No. 6,082,130 is attached as Exhibit A.

11. Plaintiffs have not infringed and are not infringing, either directly or indirectly, contributorily or otherwise any of the claims of U.S. Patent No. 6,082,130.

12. Plaintiffs cannot be liable for infringement of U.S. Patent No. 6,082,130 because the claims are invalid under one or more provisions of 35 U.S.C. §§ 102, 103, and/or 112, and/or the patent is unenforceable.

13. On information and belief, Whirlpool, either in initiating the ITC investigation or in pursuing the ITC investigation and its claims of patent infringement against LG regarding the above patent, has presented and pursued allegations of patent infringement against LG in bad faith and for ulterior purposes not proper under the law.

**Second Count: Declaratory Judgment of
Noninfringement and Invalidity of U.S. Patent No. 6,810,680**

14. Plaintiffs hereby restate and reallege the allegations set forth in paragraphs 1 through 13 and incorporate them by reference.

15. On information and belief, Defendant Maytag Corporation is the owner by assignment of U.S. Patent No. 6,810,680, entitled "Ice Maker Fill Tube Assembly." A copy of U.S. Patent No. 6,810,680 is attached as Exhibit B.

16. Plaintiffs have not infringed and are not infringing, either directly or indirectly, contributorily or otherwise any of the claims of U.S. Patent No. 6,810,680.

17. Plaintiffs cannot be liable for infringement of U.S. Patent No. 6,810,680 because the claims are invalid under one or more provisions of 35 U.S.C. §§ 102, 103, and/or 112, and/or the patent is unenforceable.

18. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain.

19. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain and that Whirlpool, in a reasonable investigation, would have found or should have found, before it filed its Complaint in the ITC.

20. On information and belief, when prosecuting and obtaining the above patent asserted by Whirlpool against LG in the ITC investigation, Whirlpool did not comply with the duty of disclosure owed to the U.S. Patent and Trademark Office and the public.

21. On information and belief, Whirlpool, either in initiating the ITC investigation or in pursuing the ITC investigation and its claims of patent infringement against LG regarding the above patent, has presented and pursued allegations of patent infringement against LG in bad faith and for ulterior purposes not proper under the law.

**Third Count: Declaratory Judgment of
Noninfringement and Invalidity of U.S. Patent No. 6,915,644**

22. Plaintiffs hereby restate and reallege the allegations set forth in paragraphs 1 through 21 and incorporate them by reference.

23. On information and belief, Defendant Maytag Corporation is the owner by assignment of U.S. Patent No. 6,915,644, entitled "Ice Maker Fill Tube Assembly." A copy of U.S. Patent No. 6,915,644 is attached as Exhibit C.

24. Plaintiffs have not infringed and are not infringing, either directly or indirectly, contributorily or otherwise any of the claims of U.S. Patent No. 6,915,644.

25. Plaintiffs cannot be liable for infringement of U.S. Patent No. 6,915,644 because the claims are invalid under one or more provisions of 35 U.S.C. §§ 102, 103, and/or 112, and/or the patent is unenforceable.

26. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain.

27. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that

Whirlpool, or its predecessors, placed into the public domain and that Whirlpool, in a reasonable investigation, would have found or should have found, before it filed its Complaint in the ITC.

28. On information and belief, when prosecuting and obtaining the above patent asserted by Whirlpool against LG in the ITC investigation, Whirlpool did not comply with the duty of disclosure owed to the U.S. Patent and Trademark Office and the public.

29. On information and belief, Whirlpool, either in initiating the ITC investigation or in pursuing the ITC investigation and its claims of patent infringement against LG regarding the above patent, has presented and pursued allegations of patent infringement against LG in bad faith and for ulterior purposes not proper under the law.

**Fourth Count: Declaratory Judgment of
Noninfringement and Invalidity of U.S. Patent No. 6,971,730**

30. Plaintiffs hereby restate and reallege the allegations set forth in paragraphs 1 through 29 and incorporate them by reference.

31. On information and belief, Defendant Maytag Corporation is the owner by assignment of U.S. Patent No. 6,971,730, entitled "Freezer Drawer Support Assembly." A copy of U.S. Patent No. 6,971,730 is attached as Exhibit D.

32. Plaintiffs have not infringed and are not infringing, either directly or indirectly, contributorily or otherwise any of the claims of U.S. Patent No. 6,971,730.

33. Plaintiffs cannot be liable for infringement of U.S. Patent No. 6,971,730 because the claims are invalid under one or more provisions of 35 U.S.C. §§ 102, 103, and/or 112, and/or the patent is unenforceable.

34. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain.

35. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain and that Whirlpool, in a reasonable investigation, would have found or should have found, before it filed its Complaint in the ITC.

36. On information and belief, when prosecuting and obtaining the above patent asserted by Whirlpool against LG in the ITC investigation, Whirlpool did not comply with the duty of disclosure owed to the U.S. Patent and Trademark Office and the public.

37. On information and belief, Whirlpool, either in initiating the ITC investigation or in pursuing the ITC investigation and its claims of patent infringement against LG regarding the above patent, has presented and pursued allegations of patent infringement against LG in bad faith and for ulterior purposes not proper under the law.

**Fifth Count: Declaratory Judgment of
Noninfringement and Invalidity of U.S. Patent No. 7,240,980**

38. Plaintiffs hereby restate and reallege the allegations set forth in paragraphs 1 through 37 and incorporate them by reference.

39. On information and belief, Defendant Maytag Corporation is the owner by assignment of U.S. Patent No. 7,240,980, entitled "Freezer Drawer Support Assembly." A copy of U.S. Patent No. 7,240,980 is attached as Exhibit E.

40. Plaintiffs have not infringed and are not infringing, either directly or indirectly, contributorily or otherwise any of the claims of U.S. Patent No. 7,240,980.

41. Plaintiffs cannot be liable for infringement of U.S. Patent No. 7,240,980 because the claims are invalid under one or more provisions of 35 U.S.C. §§ 102, 103, and/or 112, and/or the patent is unenforceable.

42. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain.

43. On information and belief, one or more numbered claims of the above patent asserted by Whirlpool against LG in the ITC investigation are invalid over prior art that Whirlpool, or its predecessors, placed into the public domain and that Whirlpool, in a reasonable investigation, would have found or should have found, before it filed its Complaint in the ITC.

44. On information and belief, when prosecuting and obtaining the above patent asserted by Whirlpool against LG in the ITC investigation, Whirlpool did not comply with the duty of disclosure owed to the U.S. Patent and Trademark Office and the public.

45. On information and belief, Whirlpool, either in initiating the ITC investigation or in pursuing the ITC investigation and its claims of patent infringement against LG regarding the above patent, has presented and pursued allegations of patent infringement against LG in bad faith and for ulterior purposes not proper under the law.

Prayers for Relief

WHEREFORE, Plaintiffs pray that this Court:

A. Declare that Plaintiffs have not infringed and are not infringing any of the claims of U.S. Patent Nos. 6,082,130, 6,810,680, 6,915,644, 6,971,730, and 7,240,980;

B. Declare that the claims of U.S. Patent Nos. 6,082,130, 6,810,680, 6,915,644, 6,971,730, and 7,240,980 are invalid and/or unenforceable;

C. Declare this case exceptional under 35 U.S.C. § 285 and award Plaintiffs their costs, disbursements, and attorney fees in connection with this action;

D. Enjoin Whirlpool from making any further allegations of infringement of the above patents against LG;

E. Order Whirlpool to take corrective measures to offset and avoid any further injury to LG; and

F. Award Plaintiffs such other and further relief, including an award of its attorney fees incurred and its damages caused by Whirlpool's allegations of patent infringement of the above patents and Whirlpool's actions and claims for relief based on that allegation, as this Court may deem just and proper.

Certification Pursuant To L.Civ.R. 11.2

Plaintiffs, by their undersigned counsel, hereby certify pursuant to L.Civ.R. 11.2 that the matters in controversy are not the subject of any other action pending in any other court or of any pending arbitration or administrative proceeding, with the exception of the pending ITC proceeding referenced above.

Dated: April 16, 2008

/s/ Thomas R. Curtin

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LG ELECTRONICS U.S.A., INC.,
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LG ELECTRONICS MONTERREY
MEXICO, S.A., DE, CV

EXHIBIT 2

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

LG ELECTRONICS U.S.A., INC. and)	
LG ELECTRONICS, INC.,)	
)	
Plaintiffs,)	
)	
v.)	C.A. No.
)	
WHIRLPOOL CORPORATION,)	
)	DEMAND FOR JURY TRIAL
)	
Defendant.)	

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs LG Electronics U.S.A., Inc. and LG Electronics, Inc. (collectively "LG"),
through counsel, allege as follows:

NATURE OF THE ACTION

1. This is an action seeking redress for patent infringement under the patent laws of
the United States, Title 35, United States Code.

THE PARTIES

2. Plaintiff LG Electronics U.S.A., Inc. ("LG USA") is a Delaware corporation
having a principal place of business at 1000 Sylvan Avenue, Englewood Cliffs, New Jersey
07632.

3. Plaintiff LG Electronics, Inc. ("LG Electronics") is a Korean corporation having a
principal place of business at LG Twin Towers, 20 Yoido-dong, Yeongdeungpo-gu, Seoul,
Korea 150-721.

4. LG U.S.A. is a wholly owned subsidiary of LG Electronics.

5. On information and belief, Defendant Whirlpool Corporation (“Whirlpool”) is a Delaware corporation having a principal place of business at 2000 North M-63, Benton Harbor, Michigan 49022.

JURISDICTION AND VENUE

6. This Court has subject matter jurisdiction under the provisions of 28 U.S.C. §§ 1331 and 1338(a).

7. This Court has personal jurisdiction over Whirlpool, as Whirlpool is incorporated in the State of Delaware.

8. Venue is proper in this judicial district under 28 U.S.C. §§ 1391(b), 1391(c), and 1400(b).

COUNT ONE: INFRINGEMENT OF U.S. PATENT NO. 7,316,121

9. LG realleges and incorporates by reference each of paragraphs 1-8 above.

10. On January 8, 2008, the United States Patent and Trademark Office (“PTO”) duly and legally issued U.S. Patent No. 7,316,121 (“the ‘121 patent”), entitled “Dispenser of Icemaker in Refrigerator.” A true and correct copy of the ‘121 patent is attached hereto as Exhibit A.

11. LG Electronics is the owner by assignment of the ‘121 patent and LG USA has the right to offer for sale and sell in the United States products covered by the ‘121 patent.

12. On information and belief, Whirlpool has been making, using, selling, and/or offering for sale refrigerators that practice the invention of the ‘121 patent and thus infringe one or more claims of the ‘121 patent. Said refrigerators include, but are not limited to, Whirlpool model nos. GC5NHAXS, GF6NFEXT, GD5VVAXT, GS6NBEXR, GS6NVEXS, and GD5NVAXS.

13. On information and belief, Whirlpool has induced infringement of and contributorily infringed the ‘121 patent, causing third parties to use certain refrigerators in a

manner that infringes the '121 patent, including, but not limited to, Whirlpool model nos. GC5NHAXS, GF6NFEXT, GD5VVAXT, GS6NBEXR, GS6NVEXS, and GD5NVAXS.

14. On information and belief, Whirlpool has been infringing the '121 patent and will continue to do so unless and until enjoined by this Court.

15. Whirlpool's acts of infringement of the '121 patent have caused LG irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

16. On information and belief, Whirlpool's acts of infringement of the '121 patent have been and continue to be willful and deliberate, rendering this case eligible for enhanced damages under 35 U.S.C. § 284 and attorney fees under 35 U.S.C. § 285.

COUNT TWO: INFRINGEMENT OF U.S. PATENT NO. 6,834,922

17. LG realleges and incorporates by reference each of paragraphs 1-16 above.

18. On December 28, 2004, the United States Patent and Trademark Office ("PTO") duly and legally issued U.S. Patent No. 6,834,922 ("the '922 patent"), entitled "Vegetable Compartment in Refrigerator." A true and correct copy of the '922 patent is attached hereto as Exhibit B.

19. LG Electronics is the owner by assignment of the '922 patent and LG USA has the right to offer for sale and sell in the United States products covered by the '922 patent.

20. On information and belief, Whirlpool markets, manufactures, sells, and/or offers for sale Maytag brand refrigerators, including, but not limited to, Maytag model no. MFI2568AE.

21. On information and belief, Whirlpool markets, manufactures, sells, and/or offers for sale Amana brand refrigerators, including, but not limited to, Amana model no. AFI2538AE.

22. On information and belief, Whirlpool markets, manufactures, sells, and/or offers for sale KitchenAid brand refrigerators, including, but not limited to, KitchenAid model no. KBFS20ETSS.

23. On information and belief, Whirlpool markets, manufactures, sells, and/or offers for sale Jenn-Air brand refrigerators, including, but not limited to, Jenn-Air model no. JFI2089AEP.

24. On information and belief, Whirlpool has been making, using, selling, and/or offering for sale refrigerators that practice the invention of the '922 patent and thus infringe one or more claims of the '922 patent. Said refrigerators include, but are not limited to, Whirlpool model nos. GX5FHDXT and GC5NHAXS, Maytag model no. MFI2568AE, Amana model no. AFI2538AE, KitchenAid model no. KBFS20ETSS, and Jenn-Air model no. JFI2089AEP.

25. On information and belief, Whirlpool has induced infringement of and contributorily infringed the '922 patent.

26. On information and belief, Whirlpool has been infringing the '922 patent and will continue to do so unless and until enjoined by this Court.

27. Whirlpool's acts of infringement of the '922 patent have caused LG irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

28. On information and belief, Whirlpool's acts of infringement of the '922 patent have been and continue to be willful and deliberate, rendering this case eligible for enhanced damages under 35 U.S.C. § 284 and attorney fees under 35 U.S.C. § 285.

COUNT THREE: INFRINGEMENT OF U.S. PATENT NO. 7,147,292

29. LG realleges and incorporates by reference each of paragraphs 1-28 above.

30. On December 12, 2006, the United States Patent and Trademark Office ("PTO") duly and legally issued U.S. Patent No. 7,147,292 ("the '292 patent"), entitled "Obturator for Refrigerator." A true and correct copy of the '292 patent is attached hereto as Exhibit C.

31. LG Electronics is the owner by assignment of the '292 patent and LG USA has the right to offer for sale and sell in the United States products covered by the '292 patent.

32. On information and belief, Whirlpool markets, manufactures, sells, and/or offers for sale Maytag brand refrigerators, including, but not limited to, Maytag model no. MFI2568AE.

33. On information and belief, Whirlpool has been making, using, selling, and/or offering for sale refrigerators that practice the invention of the '292 patent and thus infringe one or more claims of the '292 patent. Said refrigerators include, but are not limited to, Maytag model no. MFI2568AE.

34. On information and belief, Whirlpool has induced infringement of and contributorily infringed the '292 patent.

35. On information and belief, Whirlpool has been infringing the '292 patent and will continue to do so unless and until enjoined by this Court.

36. Whirlpool's acts of infringement of the '292 patent have caused LG irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

37. On information and belief, Whirlpool's acts of infringement of the '292 patent have been and continue to be willful and deliberate, rendering this case eligible for enhanced damages under 35 U.S.C. § 284 and attorney fees under 35 U.S.C. § 285.

JURY DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, LG requests a trial by jury for all issues so triable.

PRAYER FOR RELIEF

WHEREFORE, LG respectfully requests the following relief:

A. the entry of judgment that Whirlpool has infringed one or more claims of the '121, '922, and '292 patents;

B. the entry of judgment that Whirlpool's infringement of the '121, '922, and '292 patents has been deliberate and willful;

C. a permanent injunction enjoining Whirlpool, its officers, agents, servants, employees, and attorneys, and those persons in active concert or participation with them, from further infringement of the '121, '922, and '292 patents;

D. the entry of judgment awarding LG damages for Whirlpool's infringement of the '121, '922, and '292 patents;

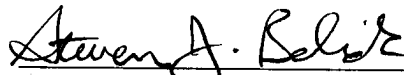
E. the entry of judgment awarding LG enhanced damages up to three times their amount pursuant to 35 U.S.C. § 284;

F. the entry of judgment awarding LG pre- and post-judgment interest on its damages, together with all costs and expenses;

G. the entry of judgment awarding LG reasonable attorney fees pursuant to 35 U.S.C. § 285; and

H. such other relief as this Court may deem just and proper.

ASHBY & GEDDES



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Dated: April 24, 2008

EXHIBIT 3

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

LG ELECTRONICS U.S.A., INC. and
LG ELECTRONICS, INC.,

Plaintiffs,

v.

WHIRLPOOL CORPORATION,

Defendant.

C. A. No. 08-234 (GMS)

Jury Trial Demanded

WHIRLPOOL CORPORATION,
WHIRLPOOL PATENTS COMPANY,
WHIRLPOOL MANUFACTURING
CORPORATION, and MAYTAG
CORPORATION,

Counterclaim Plaintiffs,

v.

LG ELECTRONICS U.S.A., INC.,
LG ELECTRONICS, INC., and LG
ELECTRONICS MONTERREY MEXICO,
S.A., DE, CV,

Counterclaim Defendants.

**WHIRLPOOL CORPORATION'S ANSWER AND AFFIRMATIVE
DEFENSES TO THE COMPLAINT AND COUNTERCLAIMS THERETO**

Defendant, Whirlpool Corporation ("Whirlpool"), files this Answer and Affirmative Defenses to the Complaint of Plaintiffs LG Electronics U.S.A., Inc. and LG Electronics, Inc., ("Plaintiffs"), and Whirlpool, Whirlpool Patents Company ("WPC"), Whirlpool Manufacturing Corporation ("WMC"), and Maytag Corporation ("Maytag") (collectively

“Counterclaim Plaintiffs”) file the following counterclaims appended hereto against Plaintiffs and LG Electronics Monterrey Mexico S.A., DE, CV (collectively “Counterclaim Defendants”):

NATURE OF THE ACTION

1. Whirlpool admits that the Complaint purports to be an action under the patent laws of the United States and denies the remaining allegations of Paragraph 1 of the Complaint.

PARTIES

2. Whirlpool admits that LG USA has a principal place of business at 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632. Whirlpool is without sufficient knowledge or information either to admit or deny the remaining allegations of Paragraph 2 of the Complaint and, on that basis, denies the remaining allegations of Paragraph 2 of the Complaint.

3. Whirlpool admits that LG has a principal place of business at LG Towers, 20 Yoido-dong, Yeongdeungpo-gu, Seoul, Korea 150-721. Whirlpool is without sufficient knowledge or information either to admit or deny the remaining allegations of Paragraph 3 of the Complaint and, on that basis, denies the remaining allegations of Paragraph 3 of the Complaint.

4. Whirlpool is without sufficient knowledge or information either to admit or deny the allegations of Paragraph 4 of the Complaint and, on that basis, denies the allegations of Paragraph 4 of the Complaint.

5. Whirlpool admits the allegations in Paragraph 5 of the Complaint.

JURISDICTION AND VENUE

6. Whirlpool admits the allegations in Paragraph 6 of the Complaint.

7. Whirlpool admits the allegations in Paragraph 7 of the Complaint.

8. Whirlpool admits the allegations in Paragraph 8 of the Complaint.

COUNT ONE: INFRINGEMENT OF U.S. PATENT NO. 7,316,121

9. Whirlpool incorporates by reference, as if set forth fully herein, its responses in Paragraphs 1 through 8 of this Answer to each and every allegation set forth in Paragraphs 1 through 8 of the Complaint.

10. Whirlpool admits that U.S. Patent No. 7,316,121 (“the ‘121 patent”) is entitled “Dispenser of Icemaker in Refrigerator” and lists January 8, 2008 as the issue date. Whirlpool admits that Plaintiffs purport to have attached a copy of the ‘121 patent as Exhibit A. Whirlpool is without sufficient knowledge or information either to admit or deny the remaining allegations of Paragraph 10 of the Complaint and, on that basis, denies the remaining allegations of Paragraph 10 of the Complaint.

11. Whirlpool is without sufficient knowledge or information either to admit or deny the allegations of Paragraph 11 of the Complaint and, on that basis, denies the allegations of Paragraph 11 of the Complaint.

12. Whirlpool admits that it has made, used, sold and/or offered for sale Whirlpool-branded refrigerator model nos. GC5NHAXS, GF6NFEXT, GD5VVAXT, GS6NBEXR, GS6NVEXS, and GD5NVAXS. Whirlpool denies the remaining allegations of Paragraph 12 of the Complaint.

13. Whirlpool denies the allegations of Paragraph 13 of the Complaint.

14. Whirlpool denies the allegations of Paragraph 14 of the Complaint.

15. Whirlpool denies the allegations of Paragraph 15 of the Complaint.

16. Whirlpool denies the allegations of Paragraph 16 of the Complaint.

COUNT TWO: INFRINGEMENT OF U.S. PATENT NO. 6,834,922

17. Whirlpool incorporates by reference, as if set forth fully herein, its responses in Paragraphs 1 through 16 of this Answer to each and every allegation set forth in Paragraphs 1 through 16 of the Complaint.

18. Whirlpool admits that U.S. Patent No. 6,834,922 (“the ‘922 patent”) is entitled “Vegetable Compartment in Refrigerator” and lists December 28, 2004 as the issue date. Whirlpool admits that Plaintiffs purport to have attached a copy of the ‘922 patent as Exhibit B. Whirlpool is without sufficient knowledge or information either to admit or deny the remaining allegations of Paragraph 18 of the Complaint and, on that basis, denies the remaining allegations of Paragraph 18 of the Complaint.

19. Whirlpool is without sufficient knowledge or information either to admit or deny the allegations of Paragraph 19 of the Complaint and, on that basis, denies the allegations of Paragraph 19 of the Complaint.

20. Whirlpool admits that it has marketed, manufactured, sold, and/or offered for sale Maytag-branded refrigerator model no. MFI2568AE.

21. Whirlpool admits that it has marketed, manufactured, sold, and/or offered for sale Amana-branded refrigerator model no. AFI2538AE.

22. Whirlpool admits that it has marketed, manufactured, sold, and/or offered for sale KitchenAid-branded refrigerator model no. KBFS20ETSS.

23. Whirlpool admits that it has marketed, manufactured, sold, and/or offered for sale Jenn-Air-branded refrigerator model no. JFI2089AEP.

24. Whirlpool admits that it has made, used, sold, and/or offered for sale Whirlpool branded model nos. GX5FHDXT and GC5NHAXS, Maytag branded model no.

MFI2568AE, Amana branded model no. AFI2538AE, KitchenAid branded model no. KBFS20ETSS, and Jenn-Air branded model no. JFI2089AEP. Whirlpool denies the remaining allegations of Paragraph 24 of the Complaint.

25. Whirlpool denies the allegations of Paragraph 25 of the Complaint.

26. Whirlpool denies the allegations of Paragraph 26 of the Complaint.

27. Whirlpool denies the allegations of Paragraph 27 of the Complaint.

28. Whirlpool denies the allegations of Paragraph 28 of the Complaint.

COUNT THREE: INFRINGEMENT OF U.S. PATENT NO. 7,147,292

29. Whirlpool incorporates by reference, as if set forth fully herein, its responses in Paragraphs 1 through 28 of this Answer to each and every allegation set forth in Paragraphs 1 through 28 of the Complaint.

30. Whirlpool admits that U.S. Patent No. 7,147,292 (“the ‘292 patent”) is entitled “Obturator for Refrigerator” and lists December 12, 2006 as the issue date. Whirlpool admits that Plaintiffs purport to have attached a copy of the ‘292 patent as Exhibit C. Whirlpool is without sufficient knowledge or information either to admit or deny the remaining allegations of Paragraph 30 of the Complaint and, on that basis, denies the remaining allegations of Paragraph 30 of the Complaint.

31. Whirlpool is without sufficient knowledge or information either to admit or deny the allegations of Paragraph 31 of the Complaint and, on that basis, denies the allegations of Paragraph 31 of the Complaint.

32. Whirlpool admits that it has marketed, manufactured, sold, and/or offered for sale Maytag-branded refrigerator model no. MFI2568AE.

33. Whirlpool admits that it has made, used, sold, and/or offered for sale Maytag-branded refrigerator model no. MFI2568AE. Whirlpool denies the remaining allegations of Paragraph 33 of the Complaint.

34. Whirlpool denies the allegations of Paragraph 34 of the Complaint.

35. Whirlpool denies the allegations of Paragraph 35 of the Complaint.

36. Whirlpool denies the allegations of Paragraph 36 of the Complaint.

37. Whirlpool denies the allegations of Paragraph 37 of the Complaint.

38. Any allegations in Paragraphs 1-37 that are not specifically admitted by Whirlpool are hereby denied.

39. Whirlpool denies that Plaintiffs are entitled to any of the relief requested in the Complaint.

AFFIRMATIVE DEFENSES

Without admitting or acknowledging that Whirlpool bears the burden of proof as to any of the following affirmative defenses, based upon information and belief, Whirlpool asserts the following affirmative defenses:

FIRST AFFIRMATIVE DEFENSE **(NON-INFRINGEMENT)**

40. Whirlpool does not infringe, has not infringed, and does not and has not induced infringement or contributed to the infringement of any valid and enforceable claim of the '121 patent, the '922 patent, or the '292 patent, either literally or under the doctrine of equivalents.

SECOND AFFIRMATIVE DEFENSE **(FAILURE TO STATE A CLAIM)**

41. Plaintiffs have failed to state a claim upon which relief can be granted.

THIRD AFFIRMATIVE DEFENSE
(INVALIDITY)

42. The one or more claims asserted by Plaintiffs of the '121 patent, the '922 patent, and the '292 patent are invalid under one or more provisions of 35 U.S.C. §§ 102, 103, and/or 112.

FOURTH AFFIRMATIVE DEFENSE
(FAILURE TO MARK)

43. On information and belief, Plaintiffs have failed to mark any refrigerator with any of the '121 patent, '922 patent or '292 patent numbers and have otherwise failed to comply with the marking and/or notice requirements set forth in 35 U.S.C. § 287. Plaintiffs are therefore barred from recovering any damages for any period prior to the filing of the Complaint.

COUNTERCLAIMS

Counterclaim Plaintiffs Whirlpool Corporation, Whirlpool Patents Company, Whirlpool Manufacturing Corporation, and Maytag Corporation allege the following counterclaims against Counterclaim Defendants LG Electronics, Inc., LG Electronics, U.S.A., Inc., and LG Electronics Monterrey Mexico, S.A., DE, CV (collectively "Counterclaim Defendants"):

THE PARTIES

44. Counterclaim Plaintiff Whirlpool Corporation is a Delaware corporation having its principal place of business at 2000 North M-63, Benton Harbor, Michigan 49022.

45. Counterclaim Plaintiff Whirlpool Patents Company is a Michigan corporation having its principal place of business at 500 Renaissance Drive, Suite 102, St. Joseph, Michigan 49085. Whirlpool Patents Company is a wholly owned subsidiary of Counterclaim Plaintiff Whirlpool Corporation.

46. Counterclaim Plaintiff Whirlpool Manufacturing Corporation is a Michigan corporation having its principal place of business at 500 Renaissance Drive, Suite 102, St. Joseph, Michigan 49085. Whirlpool Manufacturing Corporation is a wholly owned subsidiary of Counterclaim Plaintiff Whirlpool Corporation.

47. Counterclaim Plaintiff Maytag Corporation is a Delaware corporation having its principal place of business at 2000 North M-63, Benton Harbor, Michigan 49022. Maytag is a wholly owned subsidiary of Counterclaim Plaintiff Whirlpool Corporation.

48. In its Complaint, Counterclaim Defendant LG Electronics U.S.A., Inc. has alleged that it is a Delaware corporation having its principal place of business at 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632.

49. In its Complaint, Counterclaim Defendant LG Electronics, Inc. has alleged that it is a Korean corporation having its principal place of business at LG Twin Towers, 20 Yoido-dong, Yeongdeungpo-gu, Seoul, Korea 150-721. Counterclaim Defendants have also alleged that LG Electronics U.S.A., Inc. is a wholly owned subsidiary of LG Electronics, Inc.

50. On information and belief, Counterclaim Defendant LG Electronics Monterrey Mexico, S.A., DE, CV is a Mexican corporation having its principal place of business at Av. Industrias 180, Fracc Industrial Pimsa Ote., 66603 Apodaca, Nuevo Leon, Mexico.

JURISDICTION AND VENUE

51. These counterclaims arise under the patent laws of the United States, 35 U.S.C. §§ 1 *et seq.*, and the Federal Declaratory Judgment Act, 28 U.S.C. §§ 2201 and 2202. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

52. By its Complaint, LG Electronics, Inc. has alleged that it is the owner of all rights, title and interest in and to the '121 patent, the '922 patent and the '292 patent. Plaintiffs

have alleged that Whirlpool has infringed and continues to infringe the '121 patent, the '922 patent and the '292 patent. Plaintiffs have also alleged that Whirlpool has committed acts of indirect infringement by contributorily infringing and inducing others to infringe the '121 patent, the '922 patent and the '292 patent.

53. By filing this Complaint and alleging infringement on the part of Whirlpool, Plaintiffs have created a reasonable apprehension on the part of Whirlpool that Plaintiffs will maintain this lawsuit against Whirlpool or will initiate additional lawsuits against Whirlpool for infringement of the '121 patent, the '922 patent and the '292 patent, and such apprehension will persist even if Plaintiffs were subsequently to dismiss this lawsuit. For these reasons, an actual controversy within this Court's jurisdiction exists under 28 U.S.C. § 2201.

54. As set forth in the Complaint and in the Answer to which this Counterclaim is appended, a justiciable controversy has arisen and exists between Whirlpool and Plaintiffs concerning the validity and scope of the '121 patent, the '922 patent and the '292 patent and Whirlpool's liability for any alleged infringement of the '121 patent, the '922 patent and the '292 patent.

55. Plaintiffs have voluntarily submitted to the jurisdiction of the United States District Court for the District of Delaware as a result of initiating the present action within this Court. Plaintiffs are subject to personal jurisdiction in this judicial district for the purposes of Counterclaim Plaintiffs' counterclaims.

56. Counterclaim Defendant LG Electronics Monterrey Mexico, S.A., DE, CV ("LG Mexico") is subject to personal jurisdiction in this judicial district, *inter alia*, because Counterclaim Defendant LG Mexico has committed and continues to commit infringing acts in

this district and/or because Counterclaim Defendant LG Mexico has placed and continues to place infringing products into the stream of commerce which are sold in this district.

57. Venue is proper in the United States District Court for the District of Delaware as to the Plaintiffs by virtue of Plaintiffs having filed their Complaint in this judicial district.

58. Venue is proper in the judicial district as to Counterclaim Defendant LG Mexico, *inter alia*, by virtue of it being subject to personal jurisdiction in this district. *See* 28 U.S.C. § 1391(c).

FIRST COUNTERCLAIM
(DECLARATORY JUDGMENT OF NON-INFRINGEMENT)

59. Whirlpool incorporates by reference as if set forth fully herein the allegations in Paragraphs 40 through 58.

60. Whirlpool's activities do not and have not constituted infringement, either directly, contributorily, or by inducement of any valid and enforceable claim of the '121 patent, the '922 patent, or the '292 patent, either literally or under the doctrine of equivalents.

61. Whirlpool is entitled to a declaration pursuant to 28 U.S.C. § 2201 stating that Whirlpool has not infringed and does not infringe, directly or indirectly, any valid and enforceable claim of any of the patents asserted against it.

SECOND COUNTERCLAIM
(DECLARATORY JUDGMENT OF INVALIDITY)

62. Whirlpool incorporates by reference as if set forth fully herein the allegations in Paragraphs 40 through 61.

63. By their Complaint, Plaintiffs allege that the '121 patent, the '922 patent, or the '292 patent are valid. Whirlpool denies these allegations and contends that one or more

claims of each of the '121 patent, the '922 patent, and the '292 patent are invalid, under 35 U.S.C. §§ 102, 103, and/or 112. Consequently, there is an actual and justiciable controversy between Whirlpool and Plaintiffs concerning the validity of the patents.

64. Whirlpool is entitled to a declaration pursuant to 28 U.S.C. § 2201 stating that one or more claims of each of the '121 patent, the '922 patent, and the '292 patent are invalid.

THIRD COUNTERCLAIM
(DECLARATORY JUDGMENT OF FAILURE TO MARK)

65. Whirlpool incorporates by reference as if set forth fully herein the allegations in Paragraphs 40 through 64.

66. On information and belief, Counterclaim Defendants failed to comply with the marking and/or notice requirements set forth in 35 U.S.C. § 287.

67. Whirlpool is entitled to a declaration pursuant to 28 U.S.C. § 2201 stating that Plaintiffs failed to comply with the marking and/or notice requirements and are therefore barred from recovering any damages for any period prior to the filing of the Complaint.

FOURTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 6,082,130)

68. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 67 above.

69. WPC is the owner by assignment from Whirlpool of United States Patent No. 6,082,130 (“the ‘130 patent”), which was duly, properly, and legally issued to Whirlpool by virtue of an assignment from the inventors on July 4, 2000, for an invention entitled “Ice Delivery System for a Refrigerator.” A true and correct copy of the ‘130 patent is attached hereto as Exhibit A.

70. WPC has licensed rights under the ‘130 Patent to WMC, which has in turn licensed rights under the ‘130 Patent to Whirlpool. Whirlpool has the right to offer for sale and sell in the United States products covered by the ‘130 patent.

71. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the ‘130 patent, and have induced infringement of and/or contributorily infringed one or more claims of the ‘130 patent. Said refrigerators include, but are not limited to, LG model nos. LSC27950SW and LFX25980ST.

72. On information and belief, Counterclaim Defendants have been infringing the ‘130 patent and will continue to do so unless and until enjoined by this Court.

73. Counterclaim Defendants’ acts of infringement of the ‘130 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

74. On information and belief, Counterclaim Defendants' acts of infringement of the '130 patent have been and continue to be willful and deliberate, rendering this case eligible for enhanced damages under 35 U.S.C. § 284 and attorney fees under 35 U.S.C. § 285.

FIFTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 6,810,680)

75. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 74 above.

76. On November 2, 2004, the United States Patent and Trademark Office ("USPTO") duly and legally issued U.S. Patent No. 6,810,680 ("the '680 patent"), entitled "Ice Maker Fill Tube Assembly." A true and correct copy of the '680 patent is attached hereto as Exhibit B.

77. Maytag is the owner by assignment of the '680 patent and Maytag has the right to offer for sale and sell in the United States products covered by the '680 patent.

78. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the '680 patent, and have induced infringement of and/or contributorily infringed one or more claims of the '680 patent. Said refrigerators include, but are not limited to, LG model no. LSC26905SB.

79. On information and belief, Counterclaim Defendants have been infringing the '680 patent and will continue to do so unless and until enjoined by this Court.

80. Counterclaim Defendants' acts of infringement of the '680 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

81. On information and belief, Counterclaim Defendants' acts of infringement of the '680 patent have been and continue to be willful and deliberate, rendering this case eligible for enhanced damages under 35 U.S.C. § 284 and attorney fees under 35 U.S.C. § 285.

SIXTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 6,915,644)

82. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 81 above.

83. On July 12, 2005, the United States Patent and Trademark Office ("USPTO") duly and legally issued U.S. Patent No. 6,915,644 ("the '644 patent"), entitled "Ice Maker Fill Tube Assembly." A true and correct copy of the '644 patent is attached hereto as Exhibit C.

84. Maytag is the owner by assignment of the '644 patent and Maytag has the right to offer for sale and sell in the United States products covered by the '644 patent.

85. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the '644 patent, and have induced infringement of and/or contributorily infringed one or more claims of the '644 patent. Said refrigerators include, but are not limited to, LG model no. LSC26905SB.

86. On information and belief, Counterclaim Defendants have been infringing the '644 patent and will continue to do so unless and until enjoined by this Court.

87. Counterclaim Defendants' acts of infringement of the '644 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

88. On information and belief, Counterclaim Defendants' acts of infringement of the '644 patent have been and continue to be willful and deliberate, rendering this case eligible for enhanced damages under 35 U.S.C. § 284 and attorney fees under 35 U.S.C. § 285.

SEVENTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 5,269,601)

89. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 88 above.

90. WPC is the owner by assignment from Whirlpool of United States Patent No. 5,269,601 ("the '601 patent"), which was duly, properly, and legally issued to Whirlpool by virtue of an assignment from the inventors on December 14, 1993, for an invention entitled "Method and Apparatus for Manufacture of Plastic Refrigerator Liners." A true and correct copy of the '601 patent is attached hereto as Exhibit D.

91. WPC has licensed rights under the '601 Patent to WMC, which has in turn licensed rights under the '601 Patent to Whirlpool. Whirlpool has the right to offer for sale and sell in the United States products covered by the '601 patent.

92. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the '601 patent, and have induced infringement of and/or contributorily infringed one or more claims of the '601 patent. Said refrigerators include, but are not limited to, LG model nos. LSC26905SB and LSC27950SW.

93. On information and belief, Counterclaim Defendants have been infringing the '601 patent and will continue to do so unless and until enjoined by this Court.

94. Counterclaim Defendants' acts of infringement of the '601 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

EIGHTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 5,269,154)

95. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 94 above.

96. WPC is the owner by assignment from Whirlpool of United States Patent No. 5,269,154 ("the '154 patent"), which was duly, properly, and legally issued to Whirlpool by virtue of an assignment from the inventors on December 14, 1993, for an invention entitled "Heated Ice Door for Dispenser." A true and correct copy of the '154 patent is attached hereto as Exhibit E.

97. WPC has licensed rights under the '154 Patent to WMC, which has in turn licensed rights under the '154 Patent to Whirlpool Corporation. Whirlpool has the right to offer for sale and sell in the United States products covered by the '154 patent.

98. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the '154 patent, and have induced infringement of and/or contributorily infringed one or more claims of the '154 patent. Said refrigerators include, but are not limited to, LG model nos. LSC27950SW and LFX25980ST.

99. On information and belief, Counterclaim Defendants have been infringing the '154 patent and will continue to do so unless and until enjoined by this Court.

100. Counterclaim Defendants' acts of infringement of the '154 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

NINTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 6,997,526)

101. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 100 above.

102. On February 14, 2006, the United States Patent and Trademark Office ("USPTO") duly and legally issued U.S. Patent No. 6,997,526 ("the '526 patent"), entitled "Refrigerator Door Storage Systems." A true and correct copy of the '526 patent is attached hereto as Exhibit F.

103. Maytag is the owner by assignment of the '526 patent and Maytag has the right to offer for sale and sell in the United States products covered by the '526 patent.

104. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the '526 patent, and have induced infringement of and/or contributorily infringed one or more claims of the '526 patent. Said refrigerators include, but are not limited to, LG model no. LFX25980ST.

105. On information and belief, Counterclaim Defendants have been infringing the '526 patent and will continue to do so unless and until enjoined by this Court.

106. Counterclaim Defendants' acts of infringement of the '526 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

TENTH COUNTERCLAIM
(INFRINGEMENT OF U.S. PATENT NO. 7,293,846)

107. Counterclaim Plaintiffs reallege and incorporate by reference each of Paragraphs 44 through 106 above.

108. On November 13, 2007, the United States Patent and Trademark Office (“USPTO”) duly and legally issued U.S. Patent No. 7,293,846 (“the '846 patent”), entitled “Storage Bin Assembly For a Refrigerator.” A true and correct copy of the '846 patent is attached hereto as Exhibit G.

109. Although Whirlpool is identified on the face of the '846 patent as the assignee of the '846 patent, Maytag is the true owner by assignment of the '846 patent from the inventors and Maytag has the right to offer for sale and sell in the United States products covered by the '846 patent.

110. On information and belief, Counterclaim Defendants have been making, using, selling, offering for sale within, and/or importing into, the United States refrigerators that come within the scope of one or more claims of the '846 patent, and have induced infringement of and/or contributorily infringed one or more claims of the '846 patent. Said refrigerators include, but are not limited to, GE model no. PFS22MBWBBB, which is manufactured by one or more of the Counterclaim Defendants.

111. On information and belief, Counterclaim Defendants have been infringing the '846 patent and will continue to do so unless and until enjoined by this Court.

112. Counterclaim Defendants’ acts of infringement of the '846 patent have caused Counterclaim Plaintiffs irreparable injury and damages in an as-yet-undetermined amount and, unless and until enjoined by this Court, will continue to do so.

PRAYER

WHEREFORE, Whirlpool prays for judgment that:

1. Dismiss Plaintiffs' Complaint with prejudice and order that Plaintiffs be denied all relief requested in its Complaint and take nothing;
2. Enter judgment in favor of Whirlpool and against Plaintiffs on all claims in the Complaint;
3. Enter judgment that Whirlpool has not directly infringed, contributorily infringed, or induced infringement of any valid and enforceable claim of the '121 patent, the '922 patent, or the '292 patent, and does not directly infringe, contributorily infringe, or induce infringement of any valid and enforceable claim of the '121 patent, the '922 patent, or the '292 patent;
4. Enter judgment that one or more claims of each of the '121 patent, the '922 patent, and the '292 patent, including at least those claims asserted against Whirlpool, are invalid;
5. Enter judgment that Plaintiffs have failed to satisfy the marking statute and as a consequence are not entitled to any relief prior to the filing of the Complaint;
6. Enter judgment that Counterclaim Defendants have infringed one or more claims of the '130 patent, '680 patent, '644 patent, '601 patent, '154 patent, '526 patent, and '846 patent;
7. Enter judgment that Counterclaim Defendants' infringement of the '130 patent, '680 patent, and '644 patent, has been deliberate and willful;
8. Permanently enjoin Counterclaim Defendants, their officers, agents, servants, employees, and attorneys, and those persons in active concert or participation with

them, from further infringement of the '130 patent, '680 patent, '644 patent, '601 patent, '154 patent, '526 patent, and '846 patent;

9. Enter judgment awarding Counterclaim Plaintiffs damages for Counterclaim Defendants' infringement of the '130 patent, '680 patent, '644 patent, '601 patent, '154 patent, '526 patent, and '846 patent;

10. Enter judgment awarding Counterclaim Plaintiffs enhanced damages up to three times their amount pursuant to 35 U.S.C. § 284;

11. Enter judgment awarding Counterclaim Plaintiffs pre- and post-judgment interest on their damages, together with all costs and expenses;

12. Enter judgment awarding Counterclaim Plaintiffs reasonable attorney fees pursuant to 35 U.S.C. § 285; and

13. Grant such other and further relief as the Court may deem just and proper.

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Dated: May 1, 2008



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Counterclaim Plaintiffs Whirlpool Patents
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Corporation And Maytag Corporation*

JURY DEMAND

Defendant and Counterclaim Plaintiff Whirlpool and Counterclaim Plaintiffs
Whirlpool Patents Company, Whirlpool Manufacturing Corporation and Maytag Corporation
hereby demand a trial by jury for all issues so triable.

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Corporation And Maytag Corporation*

EXHIBIT 4



US006082130A

United States Patent [19]

Pastryk et al.

[11] Patent Number: **6,082,130**[45] Date of Patent: **Jul. 4, 2000**[54] **ICE DELIVERY SYSTEM FOR A REFRIGERATOR**

[75] Inventors: **Jim J. Pastryk**, New Troy; **Mark H. Nelson**, Berrien Springs; **Verne H. Myers**, St. Joseph, all of Mich.; **Daryl L. Harmon**, Newburgh, Ind.; **Andrew M. Oltman**; **Gregory G. Hortin**, both of Evansville, Ind.; **Devinder Singh**, St. Joseph, Mich.

[73] Assignee: **Whirlpool Corporation**, Benton Harbor, Minn.

[21] Appl. No.: **09/221,534**[22] Filed: **Dec. 28, 1998**[51] Int. Cl.⁷ **F25C 5/18**[52] U.S. Cl. **62/344; 222/146.6**[58] Field of Search **62/344; 222/146.6**[56] **References Cited****U.S. PATENT DOCUMENTS**

2,785,539	3/1957	Simmons et al.	62/108.5
3,025,683	3/1962	Baker et al.	62/419
3,146,601	9/1964	Gould	62/344
3,226,939	1/1966	Harbison et al.	62/344
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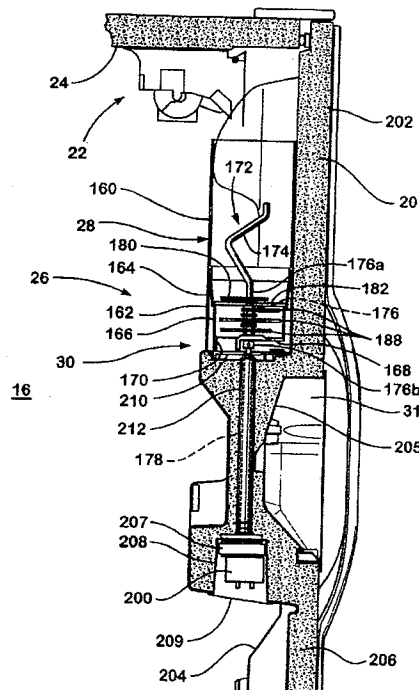
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4,176,527	12/1979	Linstromberg et al.	62/320
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4,942,979	7/1990	Linstromberg et al.	221/75
4,970,871	11/1990	Rudick	62/187
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5,050,777	9/1991	Buchser	222/146
5,160,094	11/1992	Willis et al.	62/137
5,187,950	2/1993	Weldon	62/449

Primary Examiner—William E. Tapolcai

Attorney, Agent, or Firm—Stephen D. Krefman; Joel M. Van Winkle; Robert O. Rice

[57] **ABSTRACT**

A refrigerator having a cabinet defining a freezer compartment having an access opening and a closure member for closing the access opening. An ice maker is disposed within the freezer compartment for forming ice pieces and an ice storage bin is removably mounted to the closure member below the ice maker for receiving ice from the ice maker. The ice storage bin has an upper portion which is transparent and has a bottom opening. An ice discharge chute extends through the closure member below the bottom opening of the ice storage bin. A motor is mounted on the closure member. An auger is vertically disposed within the ice storage bin and is drivingly connected to the motor. Upon energization of the motor, the auger moves ice pieces from the ice storage bin through the bottom opening to the ice discharge chute for dispensing ice pieces from the ice storage bin.

25 Claims, 7 Drawing Sheets

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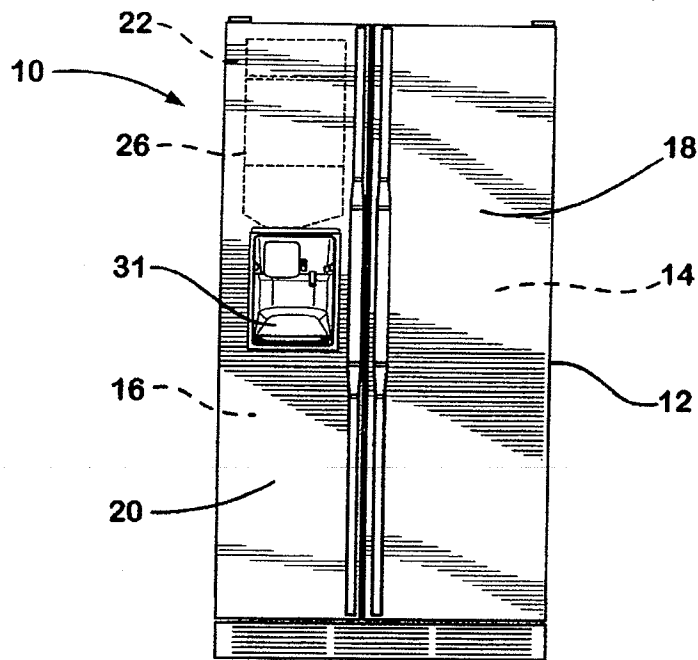


Fig. 1

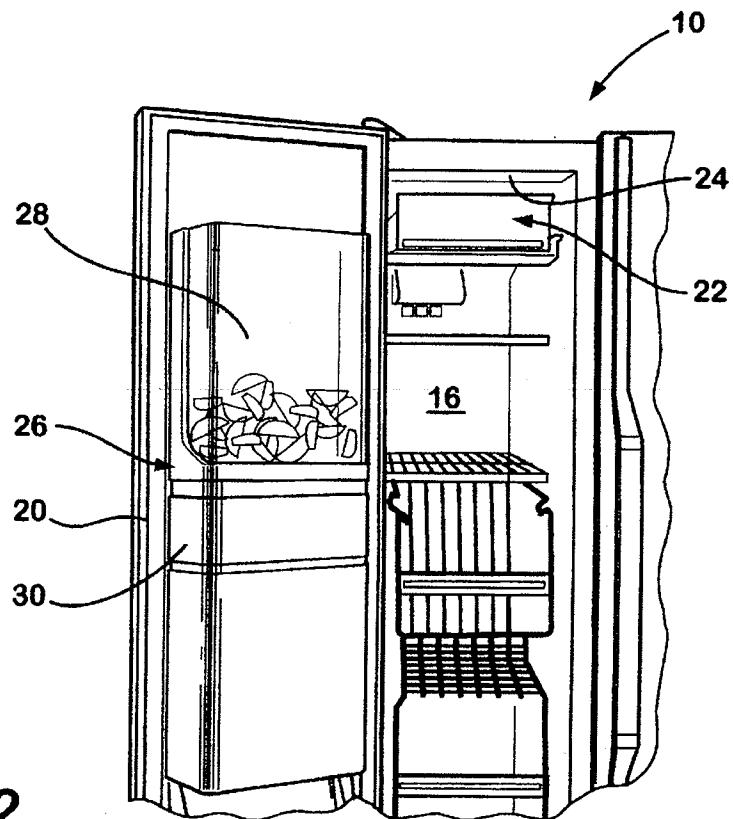


Fig. 2

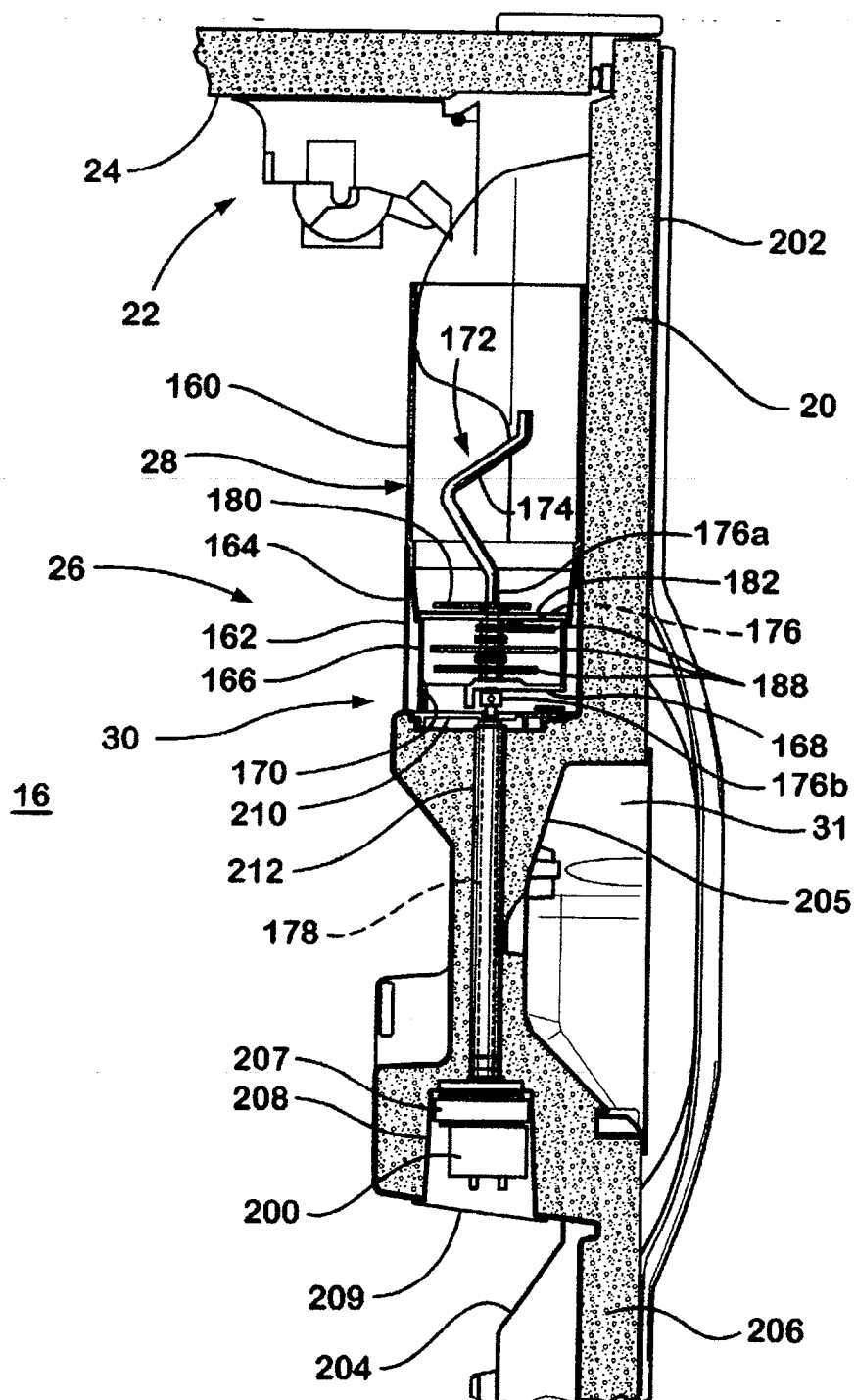


Fig. 3

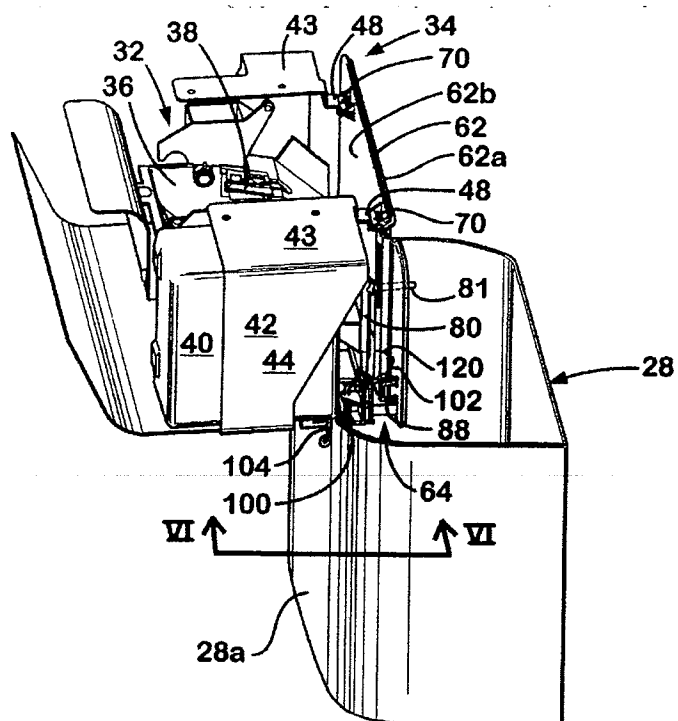


Fig. 4

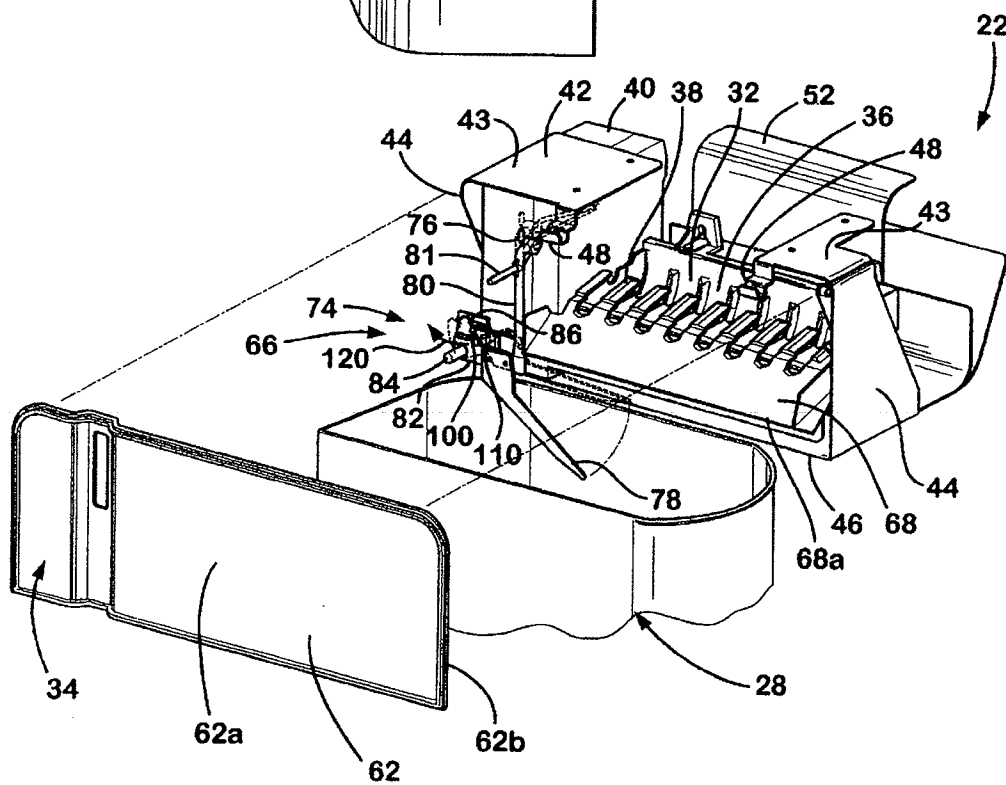


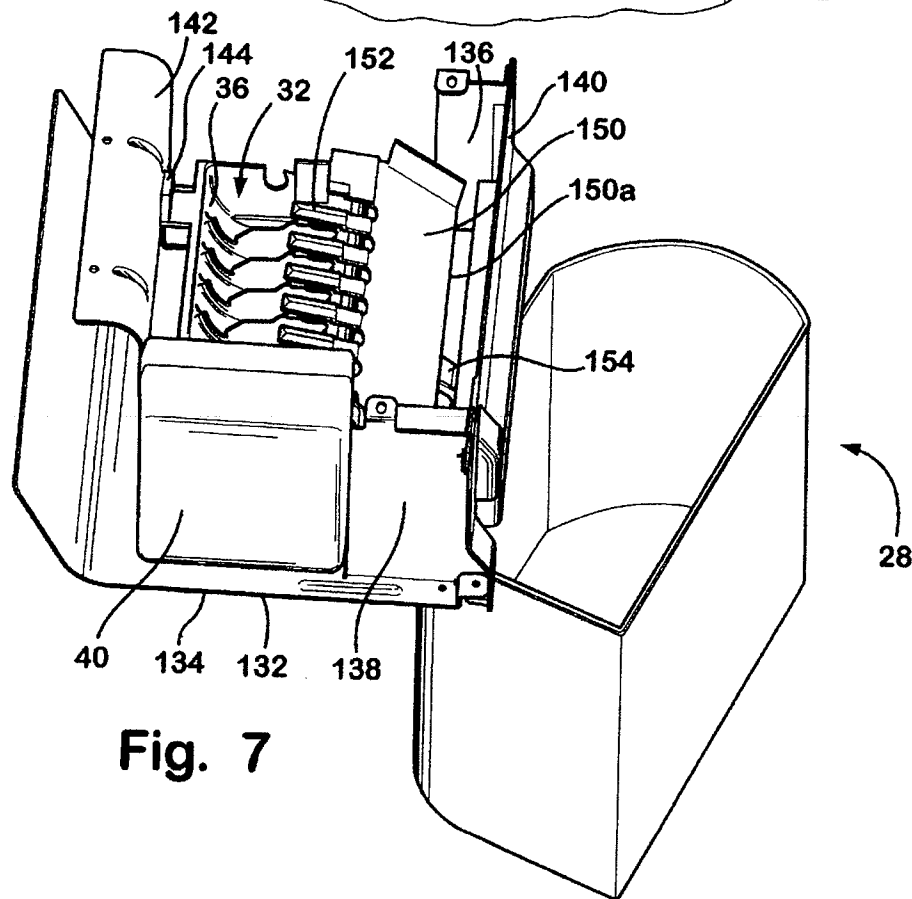
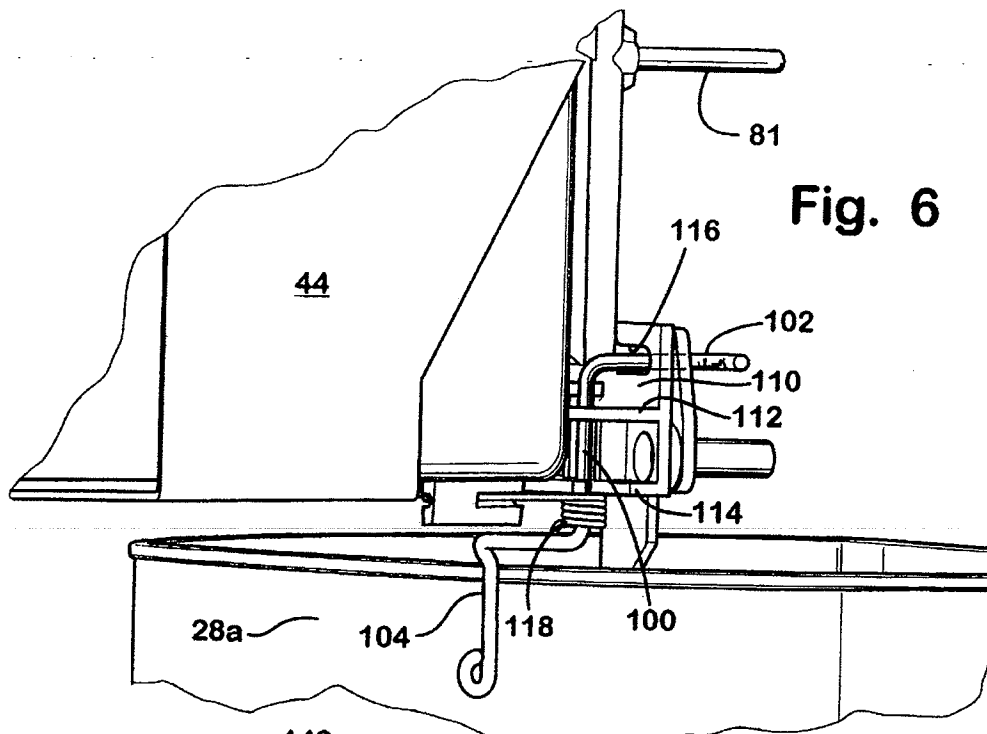
Fig. 5

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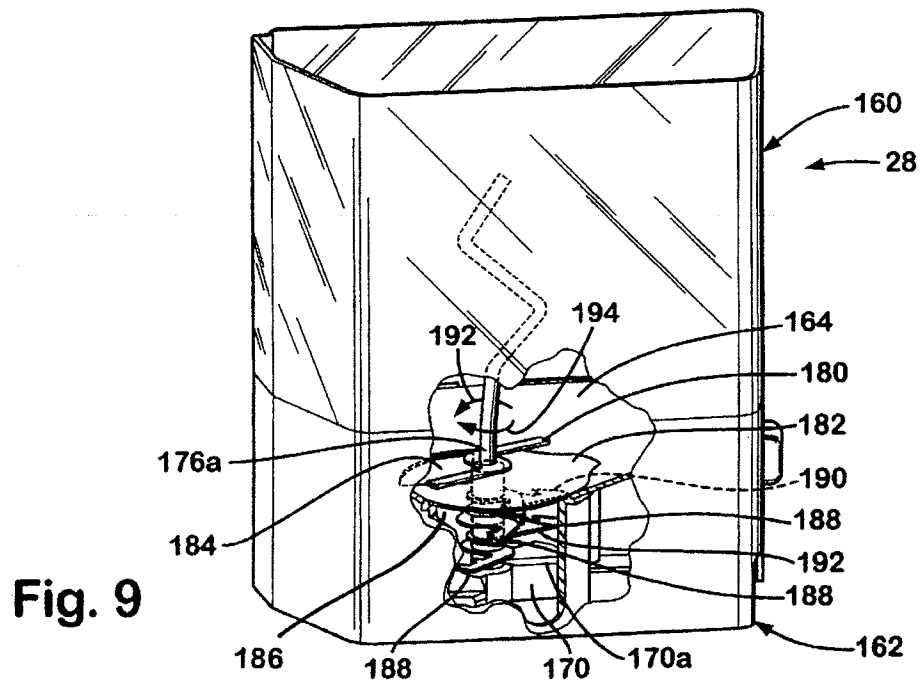
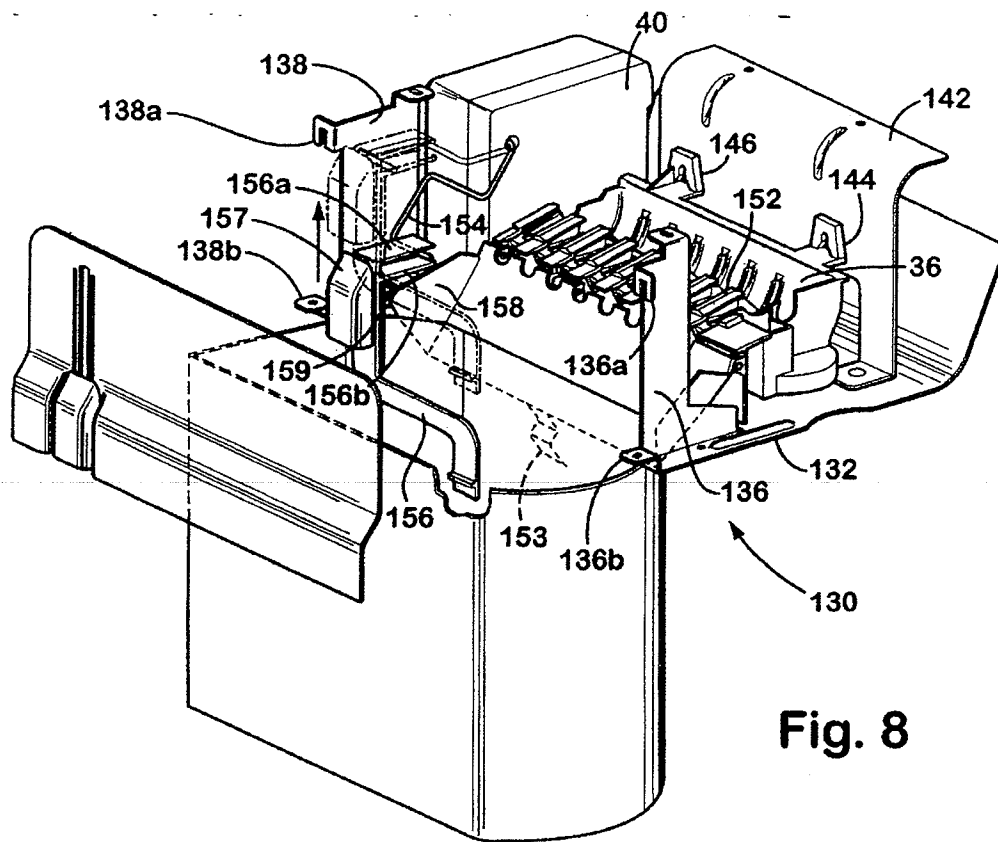


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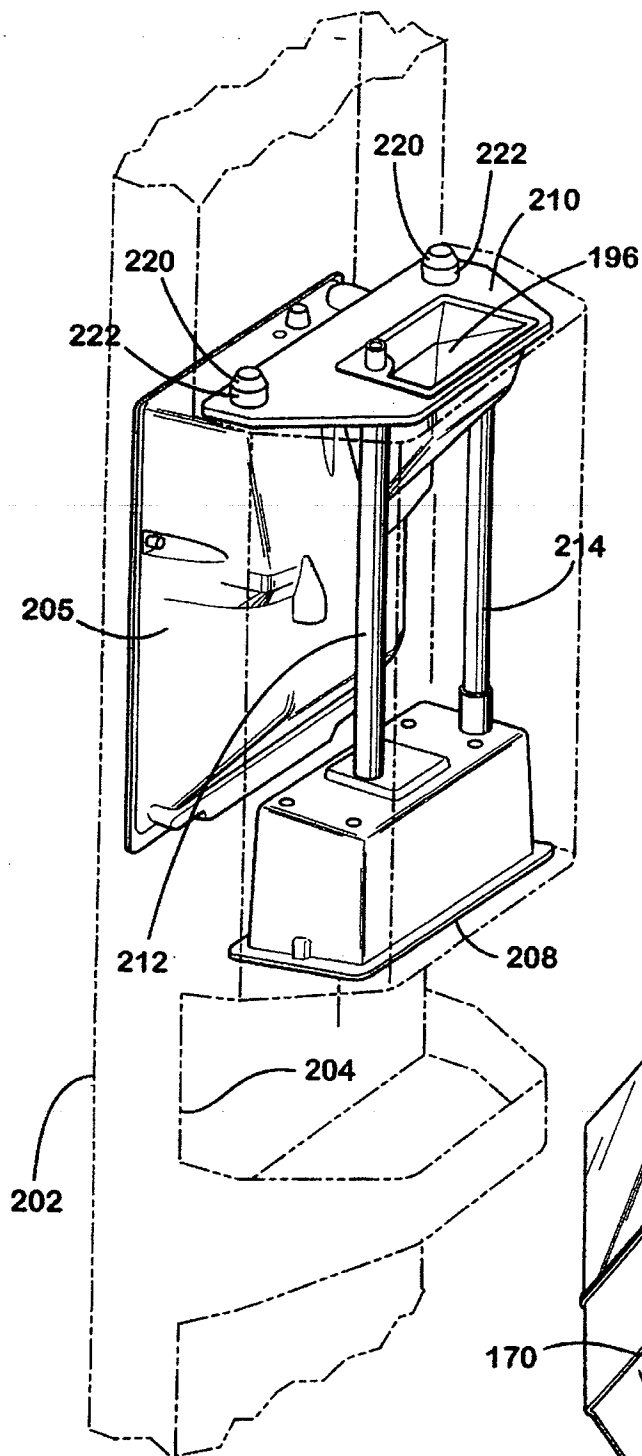


Fig. 10

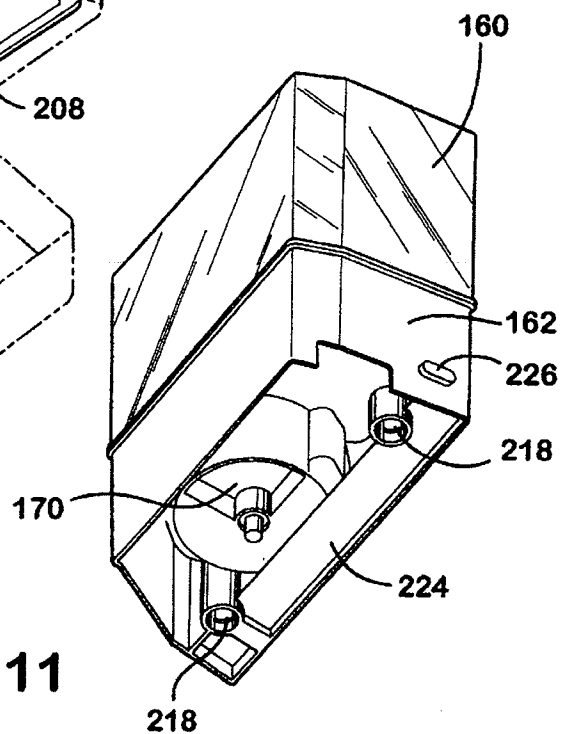


Fig. 11

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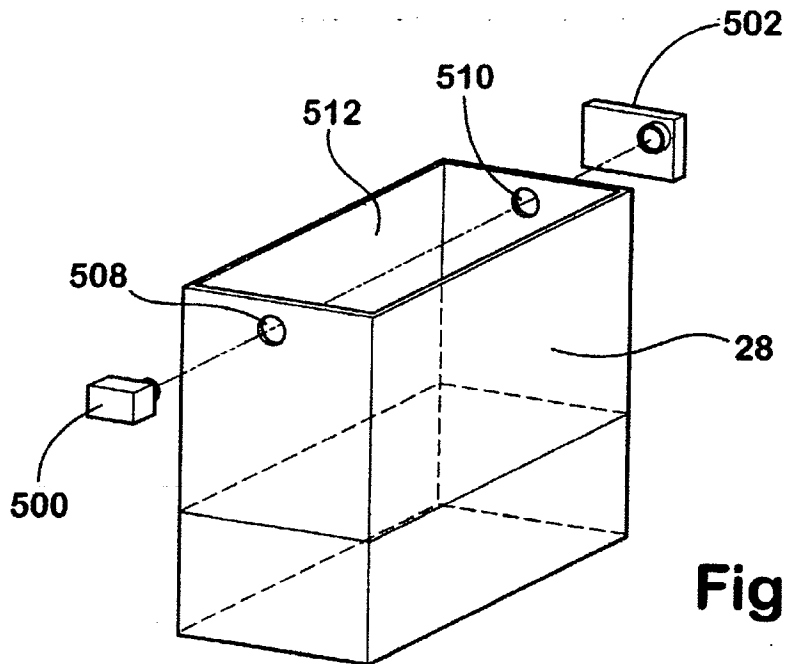


Fig. 12

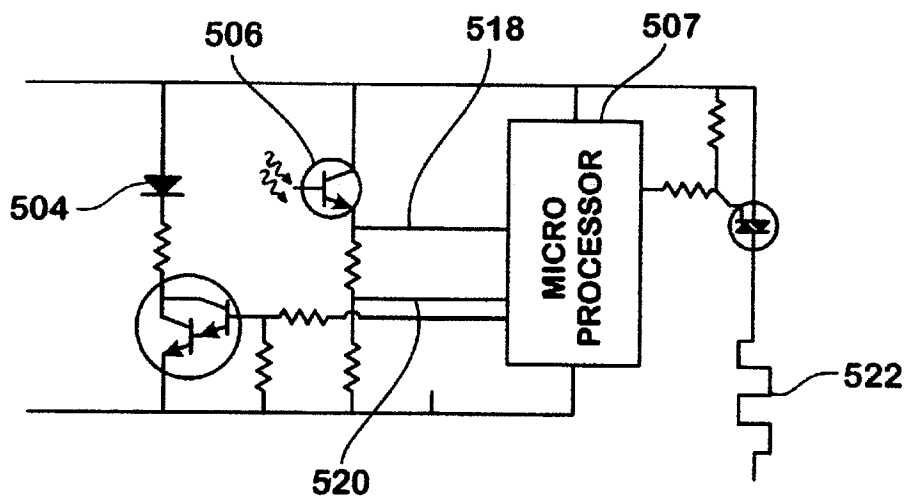


Fig. 13

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ICE DELIVERY SYSTEM FOR A REFRIGERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an ice making system for a refrigerator and more particularly to an ice delivery system mounted to a refrigerator closure member or door.

2. Description of Related Art

Automatic ice making systems for use in a home refrigerator are well known. Typically, ice making systems include an ice maker mounted within the freezer compartment of the refrigerator and an ice storage receptacle or bin supported beneath the ice maker for receiving the formed ice from the ice maker. The ice maker is commonly mounted within the freezer compartment adjacent the side or rear wall of the freezer compartment such that water and power can be readily supplied to the ice maker. The ice storage receptacle is generally supported by a shelf structure beneath the ice maker within the freezer compartment. U.S. Pat. No. 4,942,979, to Linstromberg et al. is an example of a prior art ice making system.

Ice making systems may also include ice delivery systems for automatically delivering ice pieces or bodies from the ice storage bin to a dispensing position or space provided on the external surface of the refrigerator. Conveying means, conventionally in the form of horizontally arranged augers disposed within the ice storage receptacle, have been used for transferring ice pieces from the ice storage bin through an opening provided in the freezer compartment door such that ice pieces may be automatically dispensed.

Illustratively, U.S. Pat. No. 4,084,725, to Buchser, discloses an ice dispensing apparatus for use in a domestic refrigerator having an ice maker and an ice storage receptacle mounted within a freezer compartment. The ice storage receptacle extends across the freezer compartment and has a front end adjacent the freezer door. As illustrated, a wire auger is horizontally positioned within the bottom of the ice storage receptacle and is selectively rotated by a motor when ice dispensing is desired. Ice cubes are delivered from the storage receptacle to an external service area in the freezer door by means of a rotatable tubular drum having an internal helical auger blade. The tubular drum is mounted to the end of the wire auger. When the wire auger and tubular drum are rotated, ice pieces are moved horizontally forward in the ice storage receptacle to fall into a chute for passing the ice pieces through the freezer door to the service area.

Another ice dispensing apparatus is illustrated in U.S. Pat. No. 4,176,527, to Linstromberg et al., which discloses an ice dispensing apparatus for use in a domestic refrigerator having an ice maker and an ice storage receptacle wherein ice pieces are delivered by a delivery means from the ice storage receptacle to an external service area either in the form of crushed ice or integral whole ice pieces. As shown, the ice maker and ice storage receptacle are mounted within the freezer compartment of the refrigerator. The ice storage receptacle extends across the freezer compartment and has a front end adjacent the freezer door. The transfer means comprises a rotatable wire auger horizontally disposed within the bottom of the ice storage receptacle. The wire auger has mounted at its distal end an auger blade. A motor is supported along the back wall of the freezer compartment and is drivably connected to the wire auger. When the motor is energized, the wire auger conveys ice pieces horizontally forward toward the auger blade such that ice pieces are supplied into a delivery chute wherein ice pieces are passed

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through the freezer door to the external service area. An ice crushing system may be selectively engaged such that the ice pieces may be crushed prior to delivery to the chute.

As can be seen in all of the above mentioned patent references, one aspect of conventional ice making and dispensing systems is that they occupy a relatively large amount of freezer shelf space. In particular, the ice storage bin extends across the freezer compartment and occupies a large amount of freezer compartment space. This is perceived as a disadvantage by many consumers who generally prefer to have more available shelf space. Accordingly, it would be an improvement to provide an ice making system which occupied less freezer shelf space.

Another disadvantage of prior art ice making and delivery systems is that a relatively large motor is required to rotate the ice conveying auger which is commonly provided. The motor size is related to the force necessary to break up frozen ice and move ice pieces horizontally forward within the ice receptacle.

Another disadvantage of the prior art is that the amount of ice in the ice storage receptacle is not readily visually apparent. Moreover, conventional ice making systems having automatic ice dispensing systems do not allow for easy removal of the ice storage receptacle and bulk removal of ice pieces.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a refrigerator having a cabinet defining a freezer compartment having an access opening and a closure member for closing the access opening. An ice maker is disposed within the freezer compartment for forming ice pieces and an ice storage bin is removably mounted to the closure member below the ice maker for receiving ice from the ice maker. The ice storage bin has an upper portion which is transparent and has a bottom opening. An ice discharge chute extends through the closure member below the bottom opening of the ice storage bin. A motor is mounted on the closure member. An auger is vertically disposed within the ice storage bin and is drivably connected to the motor. Upon energization of the motor, the auger moves ice pieces from the ice storage bin through the bottom opening to the ice discharge chute for dispensing ice pieces from the ice storage bin.

The ice storage bin may define an ice crushing region through which the ice pieces must pass when ice pieces are discharged through the bottom opening. The ice crushing region has an inlet opening. The auger has a shaft portion passing through the ice crushing region. At least one ice crusher blade is rotatably connected to the shaft portion for rotation within the ice crushing region. At least one stationary blade is mounted within the ice crushing region such that the ice crusher blade rotates past the stationary blade. When the motor is rotated in a first direction the ice pieces are crushed by the ice crusher blade and stationary blade prior to being dispensed through the chute and when the motor is rotated in a second direction whole ice pieces are dispensed through the ice chute.

The closure member of the present invention is a door including an inner liner, an outer wrapper and a foam material therebetween. A mounting plate is connected to the inner liner. The ice discharge chute extends through the door adjacent the mounting plate. A cup shaped support member is connected to the inner liner below the mounting plate. The ice storage bin is removably mounted to the mounting plate for receiving ice pieces. The motor is supported by the

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support member below the ice storage bin and the motor drive shaft extends from the support member to the mounting plate. The foam material is added to the door after the inner liner, outer wrapper, mounting plate and support member have been assembled such that the foam bonds to these components and secures them into position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a refrigerator apparatus having an ice storing and dispensing system embodying the present invention;

FIG. 2 is a fragmentary perspective view illustrating the ice storing and dispensing system within the freezer compartment of the refrigerator apparatus with the freezer door open;

FIG. 3 is a fragmentary, side sectional view of the ice storing and dispensing system of FIG. 1;

FIG. 4 is a fragmentary, perspective view of a first embodiment of the ice storage and dispensing system of the present invention;

FIG. 5 is a fragmentary, perspective view of the first embodiment of the ice storage and dispensing system of the present invention wherein the front cover of the ice maker has been removed;

FIG. 6 is a fragmentary, enlarged perspective view of the first embodiment of the ice storage and dispensing system of the present invention wherein the front cover has been removed, illustrating the bin lever and associated components;

FIG. 7 is a fragmentary, perspective view of a second embodiment of the ice storage and dispensing system of the present invention, illustrating the freezer door partially open;

FIG. 8 is a fragmentary, perspective view of the second embodiment of the ice storage and dispensing system of the present invention wherein the front cover has been removed, illustrating the freezer door in a closed position;

FIG. 9 is a fragmentary, enlarged, perspective view of the ice storage bin with a cut away portion illustrating the ice crusher assembly;

FIG. 10 is an enlarged, perspective view of the components of the ice storage and dispensing system of the present invention which are mounted to the freezer door wherein the freezer door liner, wrapper and insulation have been removed; and

FIG. 11 is an enlarged, perspective view of the bottom of the ice storage bin of the ice storage and dispensing system of the present invention.

FIG. 12 is a simplified, elevational view of the ice storage bin and the optical ice level sensing system.

FIG. 13 is a schematic electrical diagram illustrating the circuitry of the optical ice level sensing system of FIG. 12.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the illustrative embodiment of the invention as shown in FIGS. 1-3, a refrigerator 10, comprising a side-by-side fresh food/freezer configuration, is provided having a cabinet 12 forming an above freezing fresh food compartment 14 and a below freezing freezer compartment 16. Both the fresh food compartment 14 and the freezer compartment 16 are provided with access openings. A fresh food closure member or door 18 and a freezer closure member or door 20 are hingedly mounted to the cabinet 12 for closing the access openings, as is well known.

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An ice making assembly 22 is disposed within the freezer compartment 16. The ice making assembly 22 is mounted to the inside surface of the top wall 24 of the freezer compartment 16. An ice dispensing system 26, mounted to the freezer door 20, is provided below the ice making assembly 22 for receiving ice pieces therefrom. The ice dispensing system 26 includes an ice storage receptacle or bin 28 having an ice crushing system 30. When operated, the ice dispensing system 26 transfers ice pieces from the bin 28 through the freezer door 20 whereby ice pieces may be dispensed through a conventional, forwardly exposed ice dispenser station or external ice service area 31.

A first embodiment of the ice making assembly 22 can be described in greater detail by referring now to FIGS. 4 and 5. The ice maker assembly 22 generally comprises an ice maker 32 and an ice discharge assembly 34. The ice maker 32 is a conventional ice piece making apparatus which forms crescent shaped ice pieces. The ice maker 32 includes an ice mold body 36, an ice stripper 38, a rotatable ejector (not shown) and a housing 40. The housing surrounds a drive motor and drive module (not shown) which operate to rotate the ejector (not shown) when ice harvesting is necessary. The ice maker disclosed in U.S. Pat. No. 4,649,717, herein incorporated by reference, is illustrative of the type of ice maker used in the present invention.

The ice maker 32 is supported by a mounting bracket 42 along the upper, front portion of the freezer compartment 16. The mounting bracket 42 is attached to the top wall 24 (FIG. 3) of the freezer compartment and forms a member having a generally U-shaped cross section. The bracket 42 includes top mounting surfaces 43 which attach to the top wall 24. Side walls 44 extend downwardly along the sides of the ice maker 32. A bottom wall 46 joins the side walls 44 and forms a heat shield beneath the bottom of the ice maker 32. Downwardly directed tabs 48 depend from the top mounting surfaces 43. The ice maker 32 is attached to the mounting bracket 42 via mounting legs (not shown). An air baffle member 52 is connected to the back of the ice maker 32 and acts to direct the flow of air within the freezer compartment 16 across the ice mold 36 as will be further discussed hereinbelow.

The ice discharge assembly 34 is designed to prevent ice harvesting when the ice storage bin 28 is full of ice pieces. The need for this function is well recognized in the ice maker art. If ice harvesting is not appropriately controlled, the ice maker 32 may make an excessive quantity of ice and overflow the ice storage receptacle 28. In addition to limiting the quantity of ice produced, the ice discharge assembly 34 operates to control the discharge of ice pieces from the ice maker 32 such that ice pieces are not discharged when the freezer door 20 is open. If ice pieces are discharged when the door 20 is open, the ice pieces will fall onto the floor since the ice storage bin 28 is mounted on the door 20. To achieve these dual purposes, the ice discharge assembly 34 includes a front cover 62, a latching mechanism 64 and an ice level sensing mechanism 66 which operate together to achieve the above describe functions.

The ice stripper 38 includes a ramp 68 for directing harvested ice into the ice storage bin 28. The ramp 68 may be integrally formed with the ice stripper, as shown, or may be a separate member. The front cover 62 is pivotably supported by the tabs 48 in front of the ice maker 32. The front cover 62 is a generally flat member having a front surface 62a and a back surface 62b. The front cover includes a pair of support extensions 70 extending from the back surface 62b which are rotatably captured by the tabs 48 and allow the cover 62 to swing or pivot freely as long as the

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latching mechanism 64 is not engaged. The ramp 68 is angled downwardly and forwardly toward the back surface of the front cover 62. A bottom terminal edge 68a of the ramp 68 is disposed adjacent the back surface of the cover 62 wherein a small gap separates the bottom edge 68a and the back surface 62b of the cover 62.

When ice pieces are ready to be harvested from the ice mold body 36, the ejector and stripper 38 cooperate to remove ice pieces from the mold body 36 and urge the harvested ice pieces to slide forwardly along the stripper 38. The ice pieces slide forward off the stripper 38 and are directed to slide down the ramp 68. The spacing between the back wall of the cover 62 and the bottom edge 68a of the ramp 68 is such that ice pieces are not able to fit through the elongated gap which separates the ramp 68 and the cover 62. Accordingly, ice pieces sliding down the ramp 68 make contact with the cover 62. However, the mass of the ice pieces and the slope of the ramp 68 is such that the ice pieces push the cover 62 forward upon contact, rotating the cover 62 about the tabs 48, wherein the ice pieces are able to fall into the storage bin 28.

As mentioned above, the ice discharge assembly 34 serves to prevent overfilling of the ice storage receptacle by sensing the level of ice in the ice storage bin 28 and to prevent ice discharge when the door 20 is open. The ice level sensing mechanism 66 of the first embodiment of the ice discharge assembly, shown in FIGS. 4, 5 and 6, operates to prevent overfilling of the bin 28. The ice level sensing mechanism 66 includes a shut-off arm 76 extending from the housing 40. The shut-off arm 76 is lifted by a cam located within the housing 40 prior to and during the harvesting of ice cubes. The actuation of the shut-off arm 76 is described in U.S. Pat. No. 5,160,094 which is herein incorporated by reference.

The shut-off arm 76 is connected to a sensing finger 78 through a connecting rod 80. The finger is connected to base 82 or alternatively, the base 82 and finger may be one integral part. The base 82 is pivotally supported by a pin 84. As shown, the connecting rod 80 is rotatably connected to the shut-off arm 76 and the base 82 to allow for rotational motion of the finger 78 about the pin 84. Thus, as the shut-off arm 76 is raised during the ice harvesting cycle, the finger 78 is pivotally raised out of the storage bin 28. Once the ice pieces are harvested and have fallen into the bin 28, the finger 78 is lowered back into the bin 28.

When a sufficient amount of ice pieces have been delivered to the ice storage bin 28 so as to cause the level therein to rise to a preselected full level, the operation of the ice maker 32 will be interrupted by preventing the shut-off arm 76 from returning to its normal position. This occurs when the finger 78 contacts ice pieces when it is lowered back into the ice storage bin 28 such that it is prevented from fully descending into the bin 28. The ice maker operation will be interrupted until such time as the level of ice pieces in the bin 28 is lowered as by removing some or all of the ice bodies therein. When this occurs, the finger 78 is allowed to fully descend into the bin 28 permitting the shut-off arm 76 to return to its normal position wherein the ice maker operation is resumed. A lever 81 extends from the connecting rod through the front cover 62 to allow a user to manually deenergize the ice maker 32 by lifting the shut-off arm 76 via the lever 81.

As can be readily appreciated from the above description, every time the freezer door 20 is opened, the ice storage bin 28, being mounted on the door 20, is removed from beneath the ice making assembly 22. Accordingly, it is necessary to completely lift the ice level sensing finger 78 out of the ice

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storage bin 28 when the freezer door 20 is opened. Failure to lift the finger 78 out of the bin 28 when the door 20 is open could result in damage to the finger 78 and to the entire ice level sensing system 66.

FIG. 6 in combination with FIGS. 5 and 6 illustrate the mechanism used to lift the finger 78 out of the bin 28 when the door 20 is opened. A bin lever 100 is rotatably supported adjacent the rear wall 28a of the bin 28. The bin lever 100 is preferably a wire member having an upper latching portion 102 and a lower bin engagement portion 104 joined by a center portion. As shown in the FIG. 6, the bin lever 100 may be supported by a side extension portion 110 extending from the main body of the ramp 68. The bin lever 100 is snap fit into a pair of slotted openings provided on a support walls 112 and 114 which extend from the side extension 110. The upper latching portion 102 extends forwardly through a guide slot 116 formed into the side extension 110. The guide slot 116 ensures the proper vertical orientation of the upper latching portion 102 of the bin lever 100. It should be noted that the bin lever 100 could be supported in other ways, such as by structure extending from the housing 40.

A spring 118 engages the bin lever 100 and biases it to rotate clockwise when viewed from above, as shown by arrow 120, such that the bin engagement portion 104 is biased toward the rear wall of the bin 28a. When the door 20 is closed, the rear wall 28a of the bin 28 engages the bin engagement portion 104 winding the spring 118 and causing the bin lever 100 to rotate counterclockwise, opposite of the arrow 120. However, when the door 20 is opened, the bin lever 100 is free to rotate clockwise until the latching portion 102 engages the base of the guide slot 116.

As described above, the finger 78 is connected to the base 82 and the base is pivotally supported about the pin 84. The pin 84 extends outwardly from the side extension 110. Accordingly, lowering and raising the finger 78 is accomplished by rotating the finger about the pin 84. The base has a ramp surface 86. The ramp surface 86 is positioned within the travel of the latching portion 102 of the bin lever 100. When the door 20 is closed, the bin lever is rotated to a position which allows the finger to descend into the bin 28. However, when the door 20 is opened, the clockwise rotation of the bin lever 100 causes the latching portion 102 to engage the ramp surface 86, rotating the finger 78 up out of the bin 28. In this manner, whenever the door 20 is opened the finger 78 is lifted completely clear of the bin 28. To further ensure that damage does not occur to the finger 78 when the freezer door 20 is opened, the finger 78 may be formed from flexible plastic or elastomeric material such that finger 78 will flex if forced into contact with the bin 28.

The lifting of the finger 78, caused by the sliding engagement between the ramp surface 86 and the latching portion 102, also lifts the connecting rod 80 and the shut-off arm 76 such that the ice maker 32 is deenergized, preventing ice harvesting when the door 20 is open, thereby preventing ice from falling from the ice discharge assembly 34 when the door 20 is open.

The latching mechanism 64 further provides a means for preventing ice from falling from the ice discharge assembly 34 when the door 20 is open. The latching mechanism 64 operates to secure the front cover 62 in a closed position when the door 20 is open. The front cover 62 includes a catch 88 which extends from the back surface 62b. The catch 88 is positioned adjacent the latching portion 102 of the bin lever 100. As described above, when the door 20 is opened, the bin lever 100 rotates clockwise, as shown by arrow 120. This rotation of the bin lever 100 causes the latching portion

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102 to rotate into a position wherein the latching portion engages the catch 88 thereby preventing the cover 62 from pivoting about the tabs 48. Accordingly, whenever the door 20 is open, the bin lever 100 rotates to a position wherein the cover 62 is latched closed. When the cover 62 is latched closed, the gap between the back surface 62b and the bottom edge 68a of the ramp is insufficient for ice pieces to pass therebetween. Thus, any ice pieces which are on the ice stripper 38 or ramp 68 when the door 20 is opened are prevented from falling out of the ice discharge assembly 34 until the door 20 is again closed.

While the bin lever 100 is shown rotatably supported about a vertical axis, it can be readily understood that the bin lever could be rotatably supported about a horizontal axis. Moreover, the bin lever could be operated to lift an ice sensing finger which is slidably supported above the ice storage bin rather than an ice sensing finger which is rotatably supported.

FIGS. 7 and 8 disclose an alternative embodiment ice discharge assembly 130. In this embodiment, the ice maker 32, which is similar to the first embodiment, is supported by mounting bracket 132. The mounting bracket 132 includes a bottom shield portion 134 positioned below the ice maker 32. A pair of arms 136, 138 extend upwardly from the bottom shield portion toward the top wall 24 (FIG. 3) of the freezer compartment and provide means for rigidly mounting a front cover 140. As shown, the connection means for the front cover may include a pair of slotted tabs 136a, 138a and a pair of tabs 136b, 138b. A rear air deflector 142 also extends upwardly from the bottom shield portion 134. Both the arms 136, 138 and the rear air deflector 142 mount to the top wall 24 of the freezer compartment. The ice maker 32 is mounted to the rear air deflector 142 by a pair of mounting feet 144, 146.

A rotatable ramp 150 is connected to the ice maker 32 and may preferably be pivotably connected to an ice stripper 152. However, the ramp 150 may be pivotably connected to other ice maker components such as the ice mold. The ramp 150 is biased to rotate upwardly toward a horizontal position. The ramp 150 is preferably biased by a spring (not shown) which is between the ramp 150 and the ice maker 32. An arm portion 153 extends downwardly and outwardly from the ramp 150 and engages the ice storage bin 28 when the door 20 is closed. In this manner, as the door 20 is closed and the ice storage bin 28 is positioned beneath the ice making assembly 22, the bin 28 engages the arm 153 and rotates the ramp 150 approximately 70° into a downward position.

The ramp 150 includes a bottom terminal edge 150a. When the ramp 150 is rotated into its horizontal position, due to the door 20 being open, the terminal edge 150a is positioned adjacent the back of the front cover 140 such that any ice that is dispensed from the ice maker 32 is trapped between the ramp 150 and the front cover 140. In this manner, ice can not be discharged from the ice discharge assembly 130 when the door 20 is open. When the ramp 150 is rotated down, due to the door 20 being closed, the bottom edge 150a is moved away from the front cover 140 such that ice pieces can slide down the ramp 150 and fall into the ice storage bin 28.

In addition to preventing the discharge of ice when the freezer door 20 is open, the ice discharge assembly serves to prevent overfilling of the ice storage bin 28 by sensing the level of ice in the bin 28. To that end, a shut-off arm 154 is provided extending from the housing 40. The shut-off arm 154, similar to the shut-off arm 76, is lifted by a cam located

within the housing 40 prior to and during the harvesting of ice cubes. The actuation of the shut-off arm 154 is described in U.S. Pat. No. 5,160,094 which was previously incorporated by reference.

The shut-off arm is a wire member having a terminal portion which is drivingly connected to an ice sensing finger 156. In particular, the terminal portion of the shut-off arm 154 is disposed between a pair of horizontal walls 156a, 156b extending from the upper end of the ice sensing finger 156. The ice sensing finger 156 is slidably supported by the front cover 140 for vertical movement and has a bottom portion which extends down into the ice storage bin 28. During ice harvesting from the ice maker 32, the shut-off arm 154 lifts the ice sensing finger 156 up out of the bin 28 and then lowers the finger 156 back into the bin. When a sufficient amount of ice pieces have been delivered to the storage bin 28 so as to cause the level therein to rise to a preselected full level, the operation of the ice maker 32 will be interrupted by preventing the shut-off arm 154 from returning to its normal position. In addition to deenergizing the ice maker in response to the ice level sensing operation, a knob 157 extends from the finger 156 through the front cover 140 to allow a user to manually deenergize the ice maker 32 by lifting the shut-off arm 154 via the knob 157.

The motion of the rotatable ramp 150 during the opening of the freezer door 20 also acts to lift the finger 156 out of the bin 20 when the door 20 is opened, thereby preventing damage to the finger 156. The ramp 150 includes a side wall 158 having a rod-like extension 159. The extension 159 is disposed beneath the wall 156b of the finger 156. Upon opening the door 20, the ramp 150 rotates upwardly wherein the extension 159 engages the wall 156b and raises the finger 156 and rotates the shut-off arm up from its normal position. In this manner, the ice maker 32 is deenergized, preventing ice harvesting when the door 20 is open and thereby preventing ice pieces from falling from the ice discharge assembly 130 when the freezer door 20 is open. To further ensure that damage does not occur to the finger 156 when the freezer door 20 is opened, the finger 156 may be formed from flexible plastic or elastomeric material such that finger 156 will flex if forced into contact with the bin 28.

In the ice discharge assembly 34 of the first embodiment, shown in FIGS. 4-6, and the ice discharge assembly 130 of the second embodiment, shown in FIGS. 7 and 8, the mechanical ice level sensing systems may be replaced by an electronic optical system as shown in FIGS. 12 and 13. In an optical ice level sensing system, light (electromagnetic radiation of any wavelength) is used to sense the presence of ice pieces. An optical ice level sensing system takes advantage of the fact that ice pieces formed by a conventional ice maker, as described above, have a cloudy core which is due to air bubble entrapment, crazing during the freezing process, and water impurities among other things. This cloudy core of the ice pieces blocks a wide range of wavelengths that are generated and sensed by many standard infrared (IR) radiation products.

As shown in FIGS. 12 and 13, an optical ice level sensing system includes a light emitter 500 and receiver 502. The emitter 500 may be a printed circuit board (PCB) having a IR photo diode 504 which emits an IR light while the receiver may be a photo transistor 506 mounted to a PCB along with a microprocessor 507 and the necessary electronic circuitry to operate the optical ice level sensing system. The microprocessor 507 controls the operation of the ice level sensing system. The emitter 500 may be mounted to a side wall of the freezer compartment 16 adjacent the top of the ice storage bin 28 while the receiver

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502 is mounted to the side wall of the freezer compartment 16 opposite from the emitter. A pair of openings 508 and 510 are disposed in the ice storage bin 28 near the top surface of the bin 28 such that a line of sight or clear path 512 is created between the emitter and the receiver.

During operation of the optical system, IR radiation is generated by the emitter 500 which is directed to pass along the path 512 through the ice storage bin 28 to be received by the receiver 502. As discussed above, ice pieces, due to there cloudy core, will impede the transmission of the IR radiation such that the level of the level the IR signal received by the receiver can be used as an indicator of the ice level. When the IR photo diode 504 is pulsed, if the photo transistor 506 senses an IR signal, this indicates that the ice bin 28 is not completely filled with ice and the ice maker 32 will be operated to produce and harvest more ice pieces. If the photo transistor 506 does not sense an IR signal when the emitter 500 is pulsed, this indicated that the ice bin 28 is full of ice pieces and further ice will not be harvested.

One problem with an optical ice level sensing system is that ice can coat the photo diode 504 and the photo transistor 506 such that sending and receiving IR signals is impaired. The signal may be degraded to a point where the optical system provides a false full ice bin signal when in fact the ice storage bin is not full of ice pieces. This occurs particularly quickly when the refrigerator is operated in a hot and humid location wherein when the freezer door 20 is opened, moisture immediately condenses onto the cold surfaces within the freezer compartment 16.

This degradation can be sensed and distinguished from a normal situation as shown in FIG. 13. The microprocessor 507 receives signal 1 across line 518 and signal 2 across line 520. With clean optics, both signal 1 and 2 are read as a logic level "1" when the bin is empty and a logic level "0" when the bin is full. At some point during the degradation process, the lesser voltage at signal 2 will fall below the microprocessor input threshold and be read as a logic level "0" while the greater signal 1 is still large enough to be read as a logic level "1". Whenever signals 1 and 2 differ, ice build up has occurred and it is necessary to clean the optic system.

Heater resistors are shown as 522 which are used to clean the optics system. The heaters are physically located adjacent the photo transistor 506 and the photo diode 504. When optic cleaning is necessary, the heaters 522 are energized to warm the photo transistor 506 and the photo diode 504 such that the accumulated ice is melted away.

Turning now back to FIGS. 2 and 3, the ice dispensing system 26 can be further explained. The ice storage bin 28 is mounted to the freezer door and includes an upper ice bin member 160 and a lower ice bin member 162. The upper ice bin member 160 is formed from a clear plastic material such that the quantity of ice pieces stored within the ice bin 28 is easily visually determined. The lower ice bin member 162 is rigidly connected to the upper ice bin member 160 and includes a funnel wall portion 164, a cylindrical wall portion 166 and a bottom wall portion 168. The bottom wall portion 168 includes an ice outlet opening 170 through which the ice pieces must pass to be dispensed.

Rotatably supported within the ice bin 28 is an auger 172 having a shaped upper end 174 and a bottom shaft 176. The upper end 174 is supported within the upper ice bin member 160 and is designed to break up any large clumps of ice pieces which may be formed when ice pieces partially melt and then refreeze. Accordingly, rotation of the auger 172 ensures that the ice pieces are free to move downwardly, under the urgings of gravity, though the lower ice bin

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member and the ice crushing system 30 such that ice pieces may be dispensed. The upper end 174 of the auger 172 is also configured to avoid pushing ice pieces up and over the rim of the upper ice bin member 160.

As best seen in FIGS. 3 and 9, the bottom shaft 176 of the auger 172 is disposed within the lower ice bin member. The bottom shaft 176 is provided with a flat surface such that various parts may be assembled to the shaft for co-rotation therewith. The upper end 176a of the bottom shaft 176 is positioned within the funnel wall portion 164 and the bottom end 176b of the bottom shaft 176 extends through the bottom wall for coupling to a drive shaft 178. The coupling between the drive shaft 178 and the bottom shaft 176 may be accomplished through use of a coupling member.

Drivingly connected to the upper end 176a of the bottom shaft 176 is a bridge breaker blade 180. The bridge breaker blade 180 rotates above a blade cover 182. The blade cover 182 is a plate which is attached to the lower ice bin member at the junction between the funnel wall portion 164 and the cylindrical wall portion 166. The cover 182, together with the funnel wall portion 164, forms a bottom wall of the upper ice bin member 160. An inlet opening 184 is formed into the cover 182 through which ice pieces must pass to be discharged. The inlet opening 184 is positioned 180° opposite of the outlet opening 170. As the auger 172 rotates, ice pieces are directed by the funnel wall portion 164 toward the inlet opening 184. The bridge breaker blade 180 ensures that the inlet opening 184 does not become jammed or bridged by ice pieces thereby preventing ice dispensing.

Once ice pieces pass through the inlet opening 184 they are disposed within a cylindrical ice crushing region 186 defined by the cylindrical wall portion 166, the cover 182 and the bottom wall portion 166. The bottom shaft 176 passes through the center of this region. Extending from the bottom shaft 176 are a plurality of ice crusher blades 188. The ice crusher blades 188 are connected to the bottom shaft for co-rotation therewith. A plurality of stationary blades 190 extend between the bottom shaft 176 and the cylindrical wall portion 166. The stationary blades 190 are positioned adjacent the side edge 170a of the ice outlet opening.

Rotation of the auger 172 causes the ice pieces to pass through the inlet opening 184 and fall into the ice crushing region 186. If the auger 172 is rotated counterclockwise, as shown by arrow 192, the ice pieces within the crushing region 186 are swept by the ice crushing blades 188 from the inlet opening 184 around within the crushing region 186 to fall through the outlet opening 184. The ice pieces move from the inlet opening 184 to the outlet opening 170 without having to pass through the stationary crusher blades. In this manner, when the auger 172 is rotated in the direction of arrow 192, whole ice pieces are dispensed though the outlet opening 170 and no ice crushing occurs.

If the auger 172 is rotated clockwise, as shown by arrow 194, the ice pieces within the crushing region 186 are swept by the ice crushing blades 188 from the inlet opening and are driven into the stationary ice crushing blades 190. The rotation of the auger 172 rotates the blades 188 past the stationary blades 190 resulting in the ice pieces being crushed. The crushed ice pieces, once past the stationary blades 190, fall through the outlet opening 170. In this manner, when the auger 172 is rotated in the direction of arrow 194, crushed ice pieces are dispensed though the outlet opening 170. Once the ice pieces, in either a whole or crushed form, are passed through the ice outlet opening 170, they fall through a chute 196 formed into the freezer door 20 to a waiting receptacle positioned within the service area 31.

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While the dispensing of the ice pieces have been described with regard to the use of a plurality of crusher blades 188, the invention could readily be practiced with just one crusher blade 188 and one stationary blade 190. Moreover, the invention could dispense ice from the ice storage bin 28 without use of rotating and stationary crushing blades. For example, the rotary blades 188 and stationary blades 190 could be omitted and replaced with a paddle or other valving devices such as a pivotable or rotary door.

As just described, rotation of the auger 172 and the associated ice crusher blades 188 causes ice to be moved from the area of the upper ice bin member 160, through the ice inlet opening 184 and outlet opening 170 such that ice pieces are dispensed. The auger 172 is rotated by the drive shaft 178 which extends from a motor 200. The motor 200 is supported on the freezer door 20 below the ice service. The drive shaft 178 extends a relatively large distance between the motor and the ice bin 28.

To ensure proper operation of the ice delivery system of the present invention, it is important to rigidly and securely support the motor 200 and the ice bin 28 on the freezer door 20 since these parts must align for proper operation. The construction of the freezer door, as shown in FIG. 3, provides the necessary strength and rigidity. The freezer door 20 comprises a metallic outer wrapper 202, an inner liner 204 with a foam material 206 disposed between the wrapper 202 and the liner 204. The ice service area 31 is formed by a service housing 205 which attaches to an opening in the wrapper 202. The fabrication of the door 20 may be such that the foam material 206 is foamed in place between the wrapper 202, the liner 204 and service housing 205 and bonds to the inner surfaces of the wrapper 202, liner 204 and service housing 205 providing a great deal of strength and rigidity.

FIGS. 3 and 10 illustrate the components used to support the motor and the ice storage bin 28. The motor 200 is mounted to a bracket 207 within a cup-shaped support member or housing 208 which is connected to the inner liner 204 prior to the foaming operation. A motor cover plate 209 is placed over the open end of the housing 208 after the motor is assembled to the door. The ice bin 28 is mounted to a mounting plate 210 which is connected to the inner liner 204. A conduit 212 extends between the mounting plate 210 and the housing 208 through which the drive shaft 178 can extend. A wiring conduit 214 is also connected to the motor housing 208 and extends upwardly to connect to the housing 205. In this manner, wiring can be routed between the motor 200 and controls placed in the ice service area 31.

Accordingly, it can be understood that during fabrication of the freezer door 20, the housing 208, the mounting plate 210, the conduit 212 and the wiring conduit 214 are assembled to the inner liner 204 and then the foam 206 is foamed between the liner 204 and the wrapper 202 such that the components are bonded into position. Moreover, it can be readily appreciated by one skilled in the art that the conduits 212 and 214 may be integrally formed as part of the mounting plate 210 or the housing 208. Likewise, the mounting plate 210 or the housing 208 may be able to be integrally formed as part of the service housing 205.

One of the benefits of the present invention is that the ice bin 28 is removable from the freezer door. This allows a user to readily remove the ice bin 28 and dump a large quantity of ice into a receptacle such as an insulated cooler. FIGS. 10 and 11 best show how this is accomplished. The lower ice bin member 162 is provided with a pair of cylindrical bosses 218 or receptacles which correspond to mounting pins 220

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provided on the mounting plate 210. When the ice storage bin 28 is properly set upon the mounting plate 210, the receptacles 218 and pins 220 align. Moreover, when the bin 28 is properly placed on the plate 210, the drive shaft 178 is coupled with the auger 172 and the ice outlet 170 is disposed over the chute 196.

Means are provided for securing the bin 28 to the mounting plate 210. Each of the pins 220 are provided with an annular groove 222. A retention bar 224 is slidably supported by the lower ice bin member 162. A button 226, connected to the bar 224, is provided for longitudinally moving the retention bar 224 which is biased toward the button 226. The retention bar 224 has a pair of cut out portions (not shown) corresponding to the grooves 222. When the bin 28 is placed onto the mounting plate 210, the pins 220 are received into the receptacles 218 and the cut out portions of the retention bar 224 are engaged into the grooves 222 provided on the pins 220. When it is desired to remove the bin 28, the button 226 is depressed such that the cut out portions of the retention bar 224 are disengaged from the grooves 222, allowing separation between the plate 210 and the bottom bin member 162.

While the retention means are shown in the present description as a retention bar and a pair of pins, the present invention is not limited to this structure. For example, only one pin could be used. Moreover, the retention means could be something other than a pin and bar such as a hook and latch arrangement.

It can be seen, therefore, that the present invention provides a unique ice delivery system wherein the ice maker is located along the top wall of the freezer and the ice storage bin is mounted to the freezer door. A dispensing system including a motor is also supported on the freezer door. The present invention provides an ice storage bin which is a vertically elongated storage container with a vertically arranged auger disposed therein such that the dispensing of ice is readily accomplished. The ice storage bin is partially transparent which allows for the easy visual determination of the amount of ice in the storage bin. The present invention further provides a manner of assembling the ice storage bin and motor to the freezer door which is designed to provide adequate strength and rigidity.

While the present invention has been described with reference to the above described embodiment, those of skill in the Art will recognize that changes may be made thereto without departing from the scope of the invention as set forth in the appended claims.

We claim:

1. A refrigerator including a freezer compartment having an access opening and a closure member for closing the access opening, the refrigerator comprising:

an ice maker being disposed within the freezer compartment for forming ice pieces;

an ice storage bin mounted to the closure member below the ice maker for receiving ice from the ice maker, the ice storage bin having a bottom opening;

a motor mounted on the closure member; and

an auger disposed within the ice storage bin and drivably connected to the motor,

wherein upon energization of the motor, the auger moves ice pieces from the ice storage bin through the bottom opening for dispensing from the ice storage bin.

2. The refrigerator according to claim 1, further comprising:

an ice discharge chute through the closure member below the bottom opening of the ice storage bin wherein upon

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energization of the motor, the auger moves ice pieces from the ice storage bin through the bottom opening to the ice discharge chute.

3. The refrigerator according to claim 1, further wherein the auger is supported in a vertical orientation within the ice storage bin.

4. The refrigerator according to claim 1 further wherein the ice storage bin is at least partially formed out of a transparent material such that the amount of ice pieces in the ice storage bin can be readily visually determined.

5. The refrigerator according to claim 1 further comprising:

a breaker blade rotatably connected to the auger, the breaker blade being disposed within the ice storage bin adjacent the bottom opening of the ice storage bin.

6. The refrigerator according to claim 1 further wherein the ice storage bin comprises:

the ice storage bin defines an ice crushing region through which the ice pieces must pass when ice pieces are discharged through the bottom opening, the ice crushing region having an inlet opening;

the auger having a shaft portion passing through the ice crushing region;

at least one ice crusher blade rotatably connected to the shaft portion for rotation within the ice crushing region; and

at least one stationary blade mounted within the ice crushing region such that the ice crusher blade rotates past the stationary blade.

7. The refrigerator according to claim 6 further comprising:

a breaker blade rotatably connected to the auger, the breaker blade being disposed adjacent the inlet opening of the ice crushing region.

8. The refrigerator according to claim 1 further wherein the ice storage bin comprises:

an upper ice bin member having a bottom edge;

a lower ice bin member connected to the lower edge of the upper ice bin member, the lower ice bin member defining an ice crushing region through which the ice pieces must pass when ice pieces are discharge through the bottom opening;

the auger having a shaft portion passing through the ice crushing region;

at least one ice crusher blade rotatably connected to the shaft portion for rotation within the ice crushing region; and

at least one stationary blade mounted within the ice crushing region such that the ice crusher blade rotates past the stationary blade.

9. The refrigerator according to claim 1 wherein the ice storage bin is removable from the freezer compartment closure member.

10. A refrigerator including a cabinet for defining a freezer compartment having top wall and an access opening, the refrigerator comprising:

a closure member for closing the access opening;

an ice maker being disposed within the freezer compartment adjacent the top wall for forming ice pieces;

an ice storage bin removably mounted to the closure member below the ice maker for receiving ice from the ice maker, the ice storage bin having a bottom opening;

an ice discharge chute forming an opening through the closure member below the bottom opening of the ice storage bin;

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a motor mounted on the closure member; and

an auger vertically disposed within the ice storage bin and drivingly connected to the motor,

wherein upon energization of the motor, the auger moves ice pieces from the ice storage bin through the bottom opening to the ice discharge chute.

11. The refrigerator according to claim 10 further wherein the ice storage bin is formed out of a clear material such that the amount of ice pieces in the ice storage bin can be readily visually determined.

12. The refrigerator according to claim 10 further comprising:

a breaker blade rotatably connected to the auger, the breaker blade being disposed within the ice storage bin adjacent the bottom opening of the ice storage bin.

13. The refrigerator according to claim 10 further wherein the ice storage bin comprises:

the ice storage bin defines an ice crushing region through which the ice pieces must pass when ice pieces are discharged through the bottom opening, the ice crushing region having an inlet opening;

the auger having a shaft portion passing through the ice crushing region;

at least one ice crusher blade rotatably connected to the shaft portion for rotation within the ice crushing region; and

at least one stationary blade mounted within the ice crushing region such that the ice crusher blade rotates past the stationary blade,

wherein when the motor is rotated in a first direction the ice pieces are crushed prior to being dispensed through the chute and when the motor is rotated in a second direction whole ice pieces are dispensed through the ice chute.

14. The refrigerator according to claim 13 further comprising:

a breaker blade rotatably connected to the auger, the breaker blade being disposed adjacent the inlet opening of the ice crushing region.

15. The refrigerator according to claim 10 further wherein the ice storage bin comprises:

an transparent upper ice bin member having a bottom edge;

a lower ice bin member connected to the lower edge of the upper ice bin member, the lower ice bin member defining an ice crushing region through which the ice pieces must pass when ice pieces are discharge through the bottom opening, the ice crushing region having an inlet opening;

the auger having a shaft portion passing through the ice crushing region;

at least one ice crusher blade rotatably connected to the shaft portion for rotation within the ice crushing region; and

at least one stationary blade mounted within the ice crushing region such that the ice crusher blade rotates past the stationary blade,

wherein when the motor is rotated in a first direction the ice pieces are crushed prior to being dispensed through the chute and when the motor is rotated in a second direction whole ice pieces are dispensed through the ice chute.

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16. The refrigerator according to claim 10, further comprising:

a mounting plate connected to the closure member wherein the ice storage bin is removably mounted to the mounting plate for support on the closure member.

17. The refrigerator according to claim 16 further wherein:

the mounting plate includes at least one pin;

the ice storage bin includes at least one receptacle corresponding to the pin and a locking mechanism to secure the ice storage bin to the mounting plate.

18. A refrigerator including a cabinet defining a freezer compartment having an access opening, the refrigerator comprising:

a door hingedly mounted to the cabinet for closing the access opening, the door including an inner liner, an outer wrapper and a foam material therebetween;

a mounting plate connected to the inner liner;

an ice discharge chute extending through the door adjacent the mounting plate;

a support member connected to the inner liner below the mounting plate;

an ice storage bin removably mounted to the mounting plate for receiving ice pieces, the storage bin having a bottom opening;

a motor supported by the support member below the ice storage bin, the motor having a drive shaft extending from the support member to the mounting plate; and

an auger rotatably disposed within the ice storage bin for coupling with the drive shaft wherein upon energization of the motor, the auger moves ice pieces from the ice storage receptacle through the bottom opening to the ice discharge chute.

19. The refrigerator according to claim 18 further comprising:

an ice maker mounted within the freezer compartment for delivering ice pieces to the ice storage bin.

20. The refrigerator according to claim 18 wherein the foam material is added to the door after the inner liner, outer

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wrapper, mounting plate and support member have been assembled such that the foam bonds to these components and secures them into position.

21. The refrigerator according to claim 18 wherein the support member is a cup-shaped housing for receiving the motor.

22. The refrigerator according to claim 18 further comprising:

a conduit extending from the support member to the mounting plate through which the drive shaft extends.

23. The refrigerator according to claim 22 further comprising:

a housing mounted onto the outer wrapper defining an ice service area;

a wiring conduit extending from the support member to the housing.

24. The refrigerator according to claim 18 further wherein the ice storage bin is at least partially formed from a transparent material such that the amount of ice pieces in the ice storage bin can be readily visually determined.

25. The refrigerator according to claim 18 further wherein the ice storage bin comprises:

an upper ice bin member having a bottom edge;

a lower ice bin member connected to the lower edge of the upper ice bin member, the lower ice bin member defining an ice crushing region through which the ice pieces must pass when ice pieces are discharge through the bottom opening, the ice crushing region having an inlet opening;

the auger having a shaft portion passing through the ice crushing region;

at least one ice crusher blade rotatably connected to the shaft portion for rotation within the ice crushing region; and

at least one stationary blade mounted within the ice crushing region such that the ice crusher blade rotates past the stationary blade.

* * * * *

EXHIBIT 5



US006810680B2

(12) **United States Patent**
Pohl et al.

(10) Patent No.: **US 6,810,680 B2**
(45) Date of Patent: **Nov. 2, 2004**

(54) **ICE MAKER FILL TUBE ASSEMBLY**

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(51) Int. Cl.⁷ **F25C 5/02**

(52) U.S. Cl. **62/71; 62/420**

(58) Field of Search **62/347, 340, 300,**
62/71, 75, 353, 420

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Primary Examiner—William Doerfler

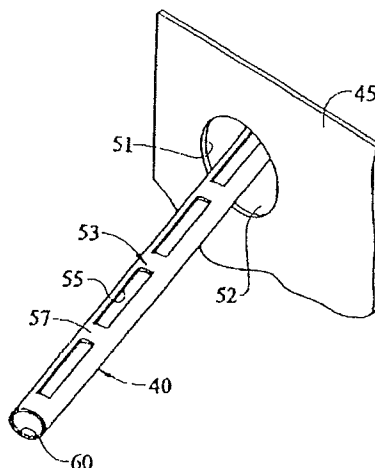
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(74) *Attorney, Agent, or Firm*—Diederiks & Whitelaw, PLC

(57) **ABSTRACT**

An ice maker assembly in a refrigerator freezer includes a fill tube for transporting liquid to a mold. The freezer includes an outer wall spaced apart from an inner wall, with a plenum formed therebetween. An opening is formed within the inner wall, through which the fill tube extends with a clearance. Warm air generated by a defrost cycle passes through the clearance in the inner wall and around the fill tube, thereby warming the fill tube. In addition, the fill tube includes vents formed therein to allow active ventilation of the fill tube and to prevent ice formation within the fill tube.

14 Claims, 2 Drawing Sheets



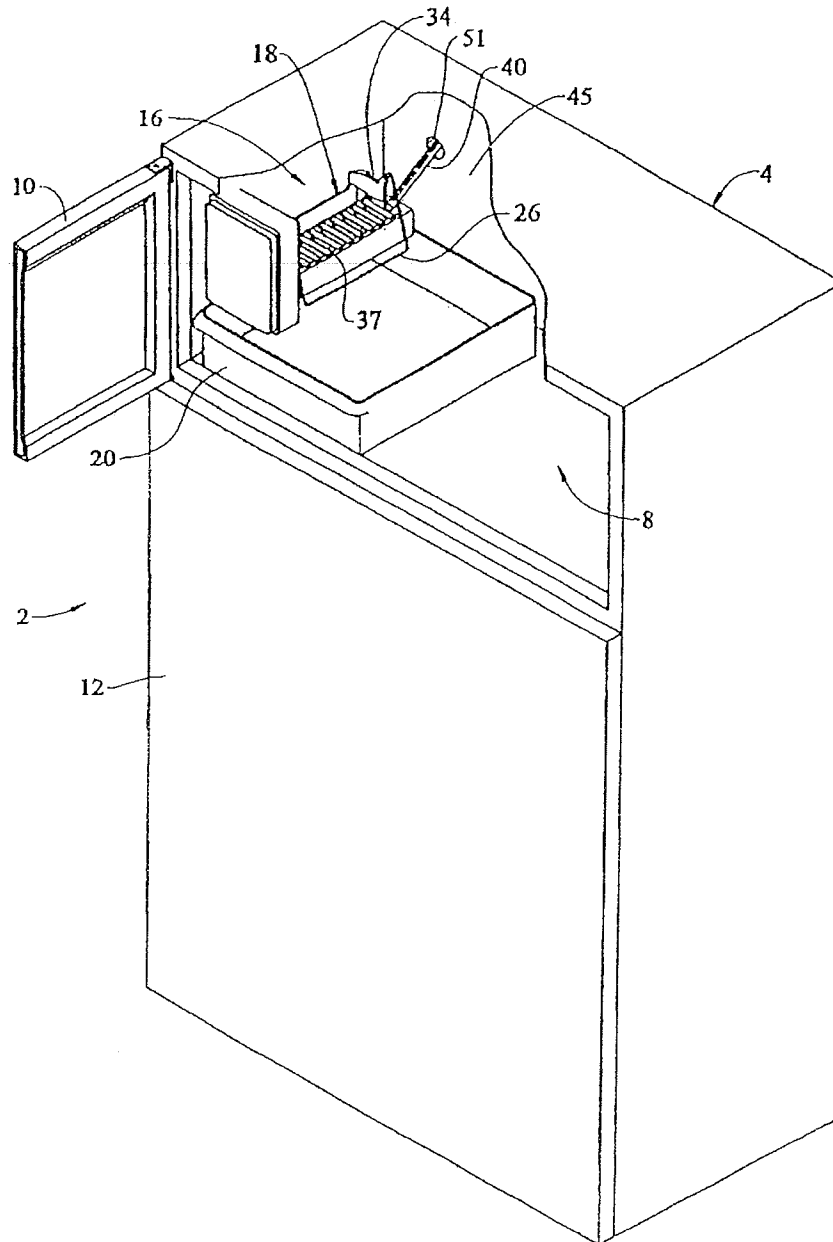
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FIG. 1



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FIG. 2

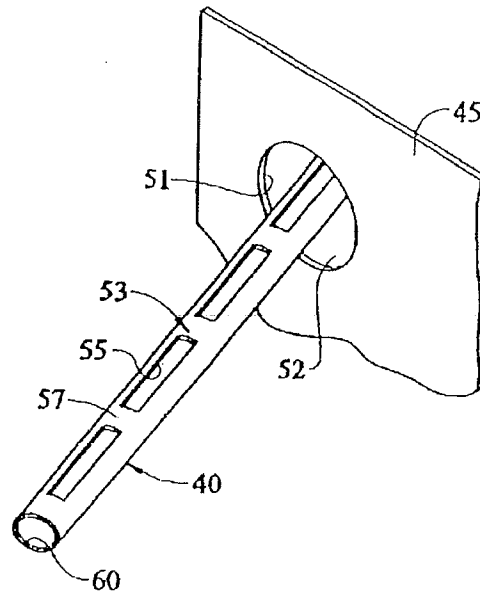
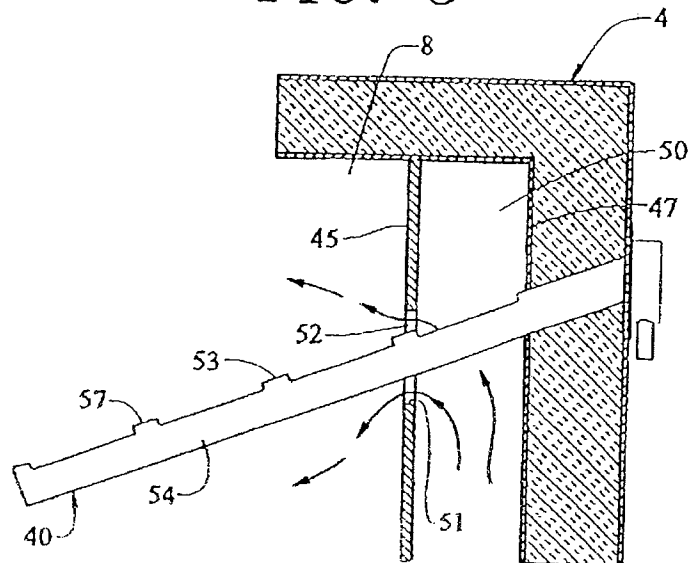


FIG. 3



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ICE MAKER FILL TUBE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to the art of refrigerators, and, more particularly, to a fill tube arrangement for an ice maker assembly provided in a freezer of a refrigerator.

2. Discussion of the Prior Art

Providing automatic ice makers in household refrigerators has become extremely commonplace. Ice makers typically include a tray that is filled by a water fill tube extending through a wall of a freezer compartment.

Since the ice maker fill tube extends into the freezer compartment, a problem exists in that water can freeze within the tube and lead to clogging of the tube. Several attempts have been made to solve this problem. For example, U.S. Pat. No. 4,020,644 discloses a water supply line that is maintained in contact with the freezer compartment outer case over a pre-selected length of the fill tube sufficient to prevent freezing of water in the fill tube. In addition, the fill tube is insulated with foam material. In the arrangement of the '644, patent, there is still a possibility that the tube may freeze. More particularly, only a portion of the tube is in heat exchange relationship with the outer case. Therefore, any heat provided by the outer case may not be sufficient to prevent freezing of other portions of the fill tube. Further, the tube is surrounded by foam and may be difficult to remove if it is necessary to clear an ice blockage within the tube.

Another attempt to solve the problem of ice formation in an ice maker fill tube is demonstrated by U.S. Pat. No. 6,157,777. In this arrangement, an ice maker fill tube includes a heater for maintaining a fluid within the tube at or above a predetermined temperature. The fill tube and heater are integrally formed so the heater is protected from physical damage. However, this arrangement adds significantly to the costs associated with manufacturing the fill tube and ice maker. Additionally, the heater arrangement will certainly affect installation and repair costs associated with the fill tube and ice maker.

Based on the known prior art, there is a need in the art for an ice maker fill tube assembly that prevents ice from freezing within the fill tube. Further, there is a need for an assembly that is inexpensive to manufacture, easy to maintain, and provides reliable protection against ice build-up.

SUMMARY OF THE INVENTION

The present invention is directed to a fill tube arranged for an ice maker assembly in a freezer compartment of a refrigerator, wherein the fill tube functions to transport liquid from a reservoir to a mold. The freezer includes an outer wall spaced apart from an inner wall, and a plenum formed therebetween. An opening is formed within the inner wall, through which the fill tube extends with a desired clearance. Warm air generated by a defrost cycle passes through the clearance in the inner wall and around the fill tube, thereby warming the fill tube.

In addition, the fill tube is provided with vents to allow active ventilation of the fill tube in order to prevent ice formation within the fill tube. Particularly, warm air generated by a defrost cycle is allowed to enter the vents formed within the fill tube to prevent freezing of the fill tube. The fill tube is also exposed to dehumidified freezer air from behind

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the inner wall. The dehumidified freezer air helps to prevent ice formation on the surface of the fill tube, as well as ice restrictions within the fill tube.

Additional objects, features and advantages of the present invention will become more readily apparent from the following detailed description of a preferred embodiment when taken in conjunction with the drawings wherein like reference numerals refer to corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial sectional view of a refrigerator having a freezer compartment incorporating the ice maker fill tube assembly constructed in accordance with the present invention;

FIG. 2 is a perspective view of the fill tube assembly of FIG. 1; and

FIG. 3 is a cross-sectional view showing the fill tube assembly and a portion of the freezer compartment of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With initial reference to FIG. 1, a refrigerator 2 includes a cabinet 4 within which is defined a freezer compartment 8. Freezer compartment 8 can be selectively accessed through the pivoting of a freezer door 10. Also provided is a fresh food door 12 which enables access to a fresh food compartment (not shown). As shown, refrigerator 2 constitutes a top-mount model. However, as will become fully evident below, the present invention is equally applicable to various types of refrigerators, including side-by-side models.

Arranged within freezer compartment 8 is an ice maker assembly 16. In a manner known in the art, ice maker assembly 16 includes an ice maker unit 18 and an ice storage bin 20. Ice maker unit 18 is shown to include a bale arm 26 which is pivotable upward and downward based on the amount of ice retained in storage bin 20. Bale arm 26 is actually pivotally connected to a switch arm 34.

Ice maker unit 18 also includes an ice mold 37. In general, this construction, as well as the operation of ice maker unit 18, is known in the art. Basically, the flow of water is directed to ice mold 37 by a fill tube 40 to fill up various cavities (not separately labeled) of ice mold 37 in order to produce ice cubes which are deposited into storage bin 20. In a typical ice maker arrangement, when the storage bin 20 has collected a sufficient number of ice cubes, the stored ice cubes will act on bale arm 26 to cause bale arm 26 to be lifted which, in turn, operates on switch arm 34 to de-activate ice maker unit 18. Bale arm 26 is biased downward to an ice making position such that, when a sufficient number of ice cubes are removed from storage bin 20, ice maker unit 18 will be automatically reactivated. Since the operation of automatic ice makers are widely known in the art, further details thereof will not be discussed here.

The present invention is particularly directed to aspects of fill tube 40 of overall ice maker assembly 16. As previously mentioned, ice maker assembly 16 is located within freezer compartment 8. Freezer compartment 8 includes an evaporator coil cover 45, which includes air flow openings (not shown), and an insulated rear wall 47 (also see FIGS. 2 and 3) which is defined by a freezer liner. As best shown in FIG. 3, within cabinet 4, evaporator coil cover 45 and insulated rear wall 47 have a plenum 50 formed therebetween. Fill tube 40 extends through insulated rear wall 47, plenum 50,

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and evaporator coil cover 45. More specifically, evaporator coil cover 45 includes an opening 51 through which fill tube 40 passes, with a clearance 52 therebetween.

By positioning fill tube 40 so that it passes through plenum 50 and opening 51 in evaporator coil cover 45 with clearance 52, fill tube 40 is exposed to active ventilation with dehumidified freezer air. More particularly, air from plenum 50 is directed around fill tube 40 due to clearance 52 between fill tube 40 and evaporator coil cover 45. Ventilation with dehumidified freezer air sublimates ice from the surface of fill tube 40 and prevents ice restrictions within fill tube 40. In addition, fill tube 40 is exposed to heat which develops behind evaporator coil cover 45 during a freezer defrost cycle. This heat serves to melt any ice which may form within fill tube 40.

In accordance with the most preferred form of the invention, fill tube 40 includes a top or upper portion 53 and a bottom or lower portion 54. The top portion 53 of fill tube 40 includes a plurality of axially spaced vents 55 formed therein. Preferably, vents 55 take the form of elongated slots and fill tube 40 is formed of a flexible PVC material. As shown in FIG. 2, vents 55 are alternated with cross ribs 57 to help maintain the structure of fill tube 40 while allowing active venting of fill tube 40. On the other hand, bottom portion 54 of fill tube 40 is solid to allow water to flow through fill tube 40 to an outlet 60.

As indicated above, when refrigerator 2 performs a defrost cycle, warm air fills plenum 50. The warm air passes through opening 51 and surrounds fill tube 40. Warm air generated by a defrost cycle also enters vents 55 formed within fill tube 40 to prevent freezing of water within fill tube 40. Fill tube 40 is also exposed to dehumidified freezer air from behind inner wall 45 which helps to prevent ice formation on the surface of fill tube 40 and prevents ice restrictions within fill tube 40. Therefore, with this overall construction, an unobstructed supply of water to make ice cubes is available.

Although described with reference to a preferred embodiment of the invention, it should be readily understood that various changes and/or modifications can be made to the invention without departing from the spirit thereof. In general, the invention is only intended to be limited by the scope of the following claims.

We claim:

1. A refrigerator freezer comprising:

an outer wall spaced apart from an inner wall, said inner wall being formed with an opening; and

an ice maker assembly including:

a mold cavity for collecting liquid to be frozen; and

a fill tube for transporting liquid to the mold cavity, said fill tube including at least one vent formed along its length, wherein the fill tube extends through the opening in the inner wall with a clearance between said inner wall and said fill tube to permit a flow of air about the fill tube through the clearance.

2. An ice maker assembly comprising:

a mold cavity for collecting liquid to be frozen; and

a fill tube for transporting liquid to the mold cavity, said fill tube including at least one vent formed along its

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length, wherein said ice maker assembly is positioned in a refrigerator freezer having an outer wall spaced apart from an inner wall, said inner wall including an opening through which the fill tube extends, said fill tube extending through the opening with a clearance between said inner wall and said fill tube to permit a flow of the air about the fill tube through the clearance.

3. The ice maker assembly of claim 2, wherein the at least one vent includes a plurality of axially spaced vents.

4. The ice maker assembly of claim 3, wherein each of said vents takes the form of a slot.

5. The ice maker assembly of claim 4, wherein the fill tube includes an upper surface portion and a lower surface portion, said vents being formed in the upper surface portion.

6. A refrigerator freezer comprising:

an outer wall spaced apart from an inner wall, said inner wall being formed with an opening; and

an ice maker assembly including:

a mold cavity for collecting liquid to be frozen; and

a liquid fill tube for transporting liquid to the mold cavity, wherein the liquid fill tube extends through the opening in the inner wall with a clearance between said inner wall and said liquid fill tube to permit a flow of air about the fill tube through the clearance.

7. The refrigerator freezer of claim 6, wherein the liquid fill tube is formed with a plurality of longitudinally spaced vents.

8. The refrigerator freezer of claim 7, wherein each of said vents takes the form of a slot.

9. The refrigerator freezer of claim 8, wherein the fill tube includes an upper surface portion and a lower surface portion, said vents being formed in the upper surface portion.

10. The refrigerator freezer of claim 6, wherein said inner wall constitutes an evaporator coil cover.

11. The refrigerator freezer of claim 6, wherein said outer wall constitutes an insulated wall of a freezer liner.

12. A method of preventing ice from forming in an ice maker fill tube of a refrigerator comprising the steps of:

generating a flow of warm air in a plenum located between an inner wall, which is formed with an opening, and an outer wall of a refrigerator freezer compartment by running a defrost cycle in the refrigerator; and

warming the fill tube, that extends through the plenum and the opening in the inner wall, by allowing the warm air to flow around the fill tube through a clearance formed between the fill tube and the opening of the inner wall.

13. The method of claim 12, further comprising: warming the fill tube by allowing the warm air to enter at least one hole formed within the fill tube.

14. The method of claim 13, further comprising: allowing the warm air to enter any one of a plurality of axially spaced holes formed along an upper surface portion of the fill tube.

* * * * *

EXHIBIT 6



US006915644B2

(12) **United States Patent**
Pohl et al.

(10) Patent No.: **US 6,915,644 B2**
(45) Date of Patent: **Jul. 12, 2005**

(54) **ICE MAKER FILL TUBE ASSEMBLY**

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(73) Assignee: **Maytag Corporation**, Newton, IA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/942,994**

(22) Filed: **Sep. 17, 2004**

(65) **Prior Publication Data**

US 2005/0028548 A1 Feb. 10, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/355,085, filed on Jan. 31, 2003, now Pat. No. 6,810,680.

(51) Int. Cl.⁷ **F25C 5/02**

(52) U.S. Cl. **62/71; 62/420**

(58) Field of Search **62/71, 74, 75,**
62/137, 344, 347, 352, 353, 420; 141/82;
137/588, 592

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Primary Examiner—William E Tapolcai

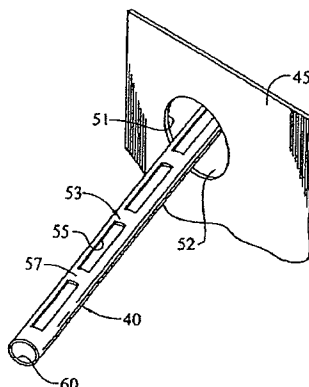
Assistant Examiner—Mohammad M. Ali

(74) Attorney, Agent, or Firm—Diedricks & Whitclaw

(57) **ABSTRACT**

An ice maker assembly in a refrigerator freezer includes a fill tube for transporting liquid to a mold. The freezer includes an outer wall spaced apart from an inner wall, with a plenum formed therebetween. An opening is formed within the inner wall, through which the fill tube extends with a clearance. Warm air generated by a defrost cycle passes through the clearance in the inner wall and around the fill tube, thereby warming the fill tube. In addition, the fill tube includes vents formed therein to allow active ventilation of the fill tube and to prevent ice formation within the fill tube.

13 Claims, 2 Drawing Sheets



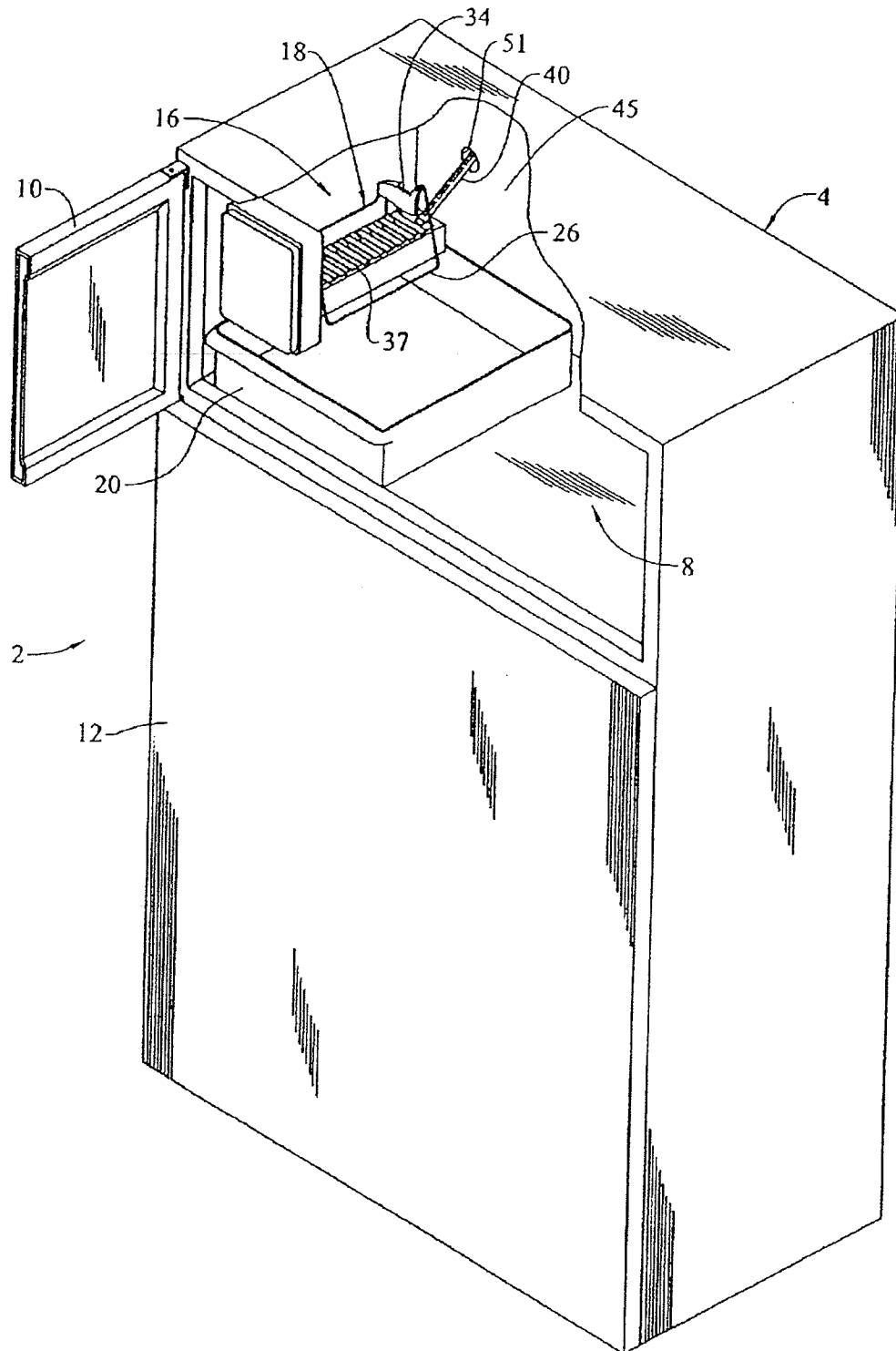
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FIG. 1



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FIG. 2

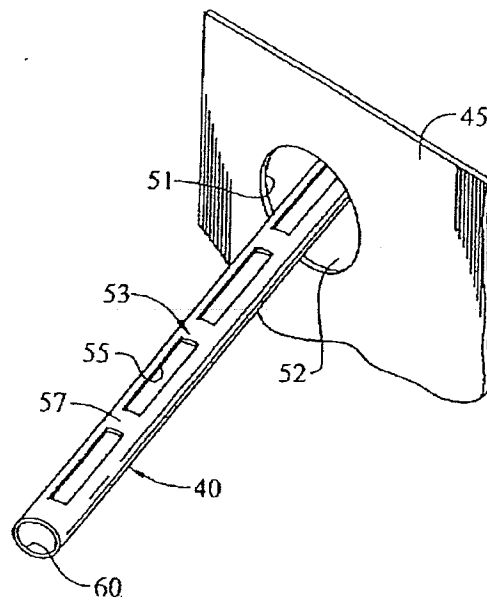
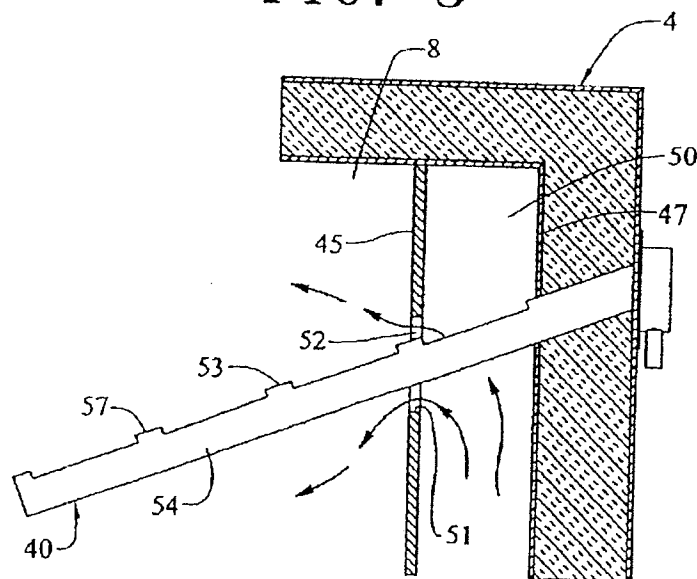


FIG. 3



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ICE MAKER FILL TUBE ASSEMBLY**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application represents a continuation of U.S. patent application Ser. No. 10/355,085 filed Jan. 31, 2003, now U.S. Pat. No. 6,810,680.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The present invention pertains to the art of refrigerators, and, more particularly, to a fill tube arrangement for an ice maker assembly provided in a freezer of a refrigerator.

2. Discussion of the Prior Art

Providing automatic ice makers in household refrigerators has become extremely commonplace. Ice makers typically include a tray that is filled by a water fill tube extending through a wall of a freezer compartment.

Since the ice maker fill tube extends into the freezer compartment, a problem exists in that water can freeze within the tube and lead to clogging of the tube. Several attempts have been made to solve this problem. For example, U.S. Pat. No. 4,020,644 discloses a water supply line that is maintained in contact with the freezer compartment outer case over a pre-selected length of the fill tube sufficient to prevent freezing of water in the fill tube. In addition, the fill tube is insulated with foam material. In the arrangement of the '644 patent, there is still a possibility that the tube may freeze. More particularly, only a portion of the tube is in heat exchange relationship with the outer case. Therefore, any heat provided by the outer case may not be sufficient to prevent freezing of other portions of the fill tube. Further, the tube is surrounded by foam and may be difficult to remove if it is necessary to clear an ice blockage within the tube.

Another attempt to solve the problem of ice formation in an ice maker fill tube is demonstrated by U.S. Pat. No. 6,157,777. In this arrangement, an ice maker fill tube includes a heater for maintaining a fluid within the tube at or above a predetermined temperature. The fill tube and heater are integrally formed so the heater is protected from physical damage. However, this arrangement adds significantly to the costs associated with manufacturing the fill tube and ice maker. Additionally, the heater arrangement will certainly affect installation and repair costs associated with the fill tube and ice maker.

Based on the known prior art, there is a need in the art for an ice maker fill tube assembly that prevents ice from freezing within the fill tube. Further, there is a need for an assembly that is inexpensive to manufacture, easy to maintain, and provides reliable protection against ice build-up.

SUMMARY OF THE INVENTION

The present invention is directed to a fill tube arranged for an ice maker assembly in a freezer compartment of a refrigerator, wherein the fill tube functions to transport liquid from a reservoir to a mold. The freezer includes an outer wall spaced apart from an inner wall, and a plenum formed therebetween. An opening is formed within the inner wall, through which the fill tube extends with a desired clearance. Warm air generated by a defrost cycle passes through the clearance in the inner wall and around the fill tube, thereby warming the fill tube.

In addition, the fill tube is formed with vents to allow active ventilation of the fill tube in order to prevent ice

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formation within the fill tube. Particularly, warm air generated by a defrost cycle is allowed to enter the vents formed within the fill tube to prevent freezing of the fill tube. The fill tube is also exposed to dehumidified freezer air from behind the inner wall. The dehumidified freezer air helps to prevent ice formation on the surface of the fill tube, as well as ice restrictions within the fill tube.

Additional objects, features and advantages of the present invention will become more readily apparent from the following detailed description of a preferred embodiment when taken in conjunction with the drawings wherein like reference numerals refer to corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial sectional view of a refrigerator having a freezer compartment incorporating the ice maker fill tube assembly constructed in accordance with the present invention;

FIG. 2 is a perspective view of the fill tube assembly of FIG. 1; and

FIG. 3 is a cross-sectional view showing the fill tube assembly and a portion of the freezer compartment of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With initial reference to FIG. 1, a refrigerator 2 includes a cabinet 4 within which is defined a freezer compartment 8. Freezer compartment 8 can be selectively accessed through the pivoting of a freezer door 10. Also provided is a fresh food door 12 which enables access to a fresh food compartment (not shown). As shown, refrigerator 2 constitutes a top-mount model. However, as will become fully evident below, the present invention is equally applicable to various types of refrigerators, including side-by-side models.

Arranged within freezer compartment 8 is an ice maker assembly 16. In a manner known in the art, ice maker assembly 16 includes an ice maker unit 18 and an ice storage bin 20. Ice maker unit 18 is shown to include a bale arm 26 which is pivotable upward and downward based on the amount of ice retained in storage bin 20. Bale arm 26 is actually pivotally connected to a switch arm 34.

Ice maker unit 18 also includes an ice mold 37. In general, this construction, as well as the operation of ice maker unit 18, is known in the art. Basically, the flow of water is directed to ice mold 37 by a fill tube 40 to fill up various cavities (not separately labeled) of ice mold 37 in order to produce ice cubes which are deposited into storage bin 20. In a typical ice maker arrangement, when the storage bin 20 has collected a sufficient number of ice cubes, the stored ice cubes will act on bale arm 26 to cause bale arm 26 to be lifted which, in turn, operates on switch arm 34 to de-activate ice maker unit 18. Bale arm 26 is biased downward to an ice making position such that, when a sufficient number of ice cubes are removed from storage bin 20, ice maker unit 18 will be automatically reactivated. Since the operation of automatic ice makers are widely known in the art, further details thereof will not be discussed here.

The present invention is particularly directed to aspects of fill tube 40 of overall ice maker assembly 16. As previously mentioned, ice maker assembly 16 is located within freezer compartment 8. Freezer compartment 8 includes an evaporator coil cover 45, which includes air flow openings (not shown), and an insulated rear wall 47 (also see FIGS. 2 and

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3) which is defined by a freezer liner. As best shown in FIG. 3, within cabinet 4, evaporator coil cover 45 and insulated rear wall 47 have a plenum 50 formed therebetween. Fill tube 40 extends through insulated rear wall 47, plenum 50, and evaporator coil cover 45. More specifically, evaporator coil cover 45 includes an opening 51 through which fill tube 40 passes, with a clearance 52 therebetween.

By positioning fill tube 40 so that it passes through plenum 50 and opening 51 in evaporator coil cover 45 with clearance 52, fill tube 40 is exposed to active ventilation with dehumidified freezer air. More particularly, air from plenum 50 is directed around fill tube 40 due to clearance 52 between fill tube 40 and evaporator coil cover 45. Ventilation with dehumidified freezer air sublimates ice from the surface of fill tube 40 and prevents ice restrictions within fill tube 40. In addition, fill tube 40 is exposed to heat which develops behind evaporator coil cover 45 during a freezer defrost cycle. This heat serves to melt any ice which may form within fill tube 40.

In accordance with the most preferred form of the invention, fill tube 40 includes a top or upper portion 53 and a bottom or lower portion 54. The top portion 53 of fill tube 40 includes a plurality of axially spaced vents 55 formed therein. Preferably, vents 55 take the form of elongated slots and fill tube 40 is formed of a flexible PVC material. As shown in FIG. 2, vents 55 are alternated with cross ribs 57 to help maintain the structure of fill tube 40 while allowing active venting of fill tube 40. On the other hand, bottom portion 54 of fill tube 40 is solid to allow water to flow through fill tube 40 to an outlet 60.

As indicated above, when refrigerator 2 performs a defrost cycle, warm air fills plenum 50. The warm air passes through opening 51 and surrounds fill tube 40. Warm air generated by a defrost cycle also enters vents 55 formed within fill tube 40 to prevent freezing of water within fill tube 40. Fill tube 40 is also exposed to dehumidified freezer air from behind inner wall 45 which helps to prevent ice formation on the surface of fill tube 40 and prevents ice restrictions within fill tube 40. Therefore, with this overall construction, an unobstructed supply of water to make ice cubes is available.

Although described with reference to a preferred embodiment of the invention, it should be readily understood that various changes and/or modifications can be made to the invention without departing from the spirit thereof. In general, the invention is only intended to be limited by the scope of the following claims.

What is claimed is:

1. An ice maker assembly comprising:

a mold cavity for collecting liquid to be frozen; and
a fill tube for transporting liquid to the mold cavity, said fill tube including at least one vent formed along its length, wherein the at least one vent includes a plurality of axially spaced vents for a ventilating flow of air.

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2. The ice maker assembly of claim 1, wherein each of said vents takes the form of a slot.

3. The ice maker assembly of claim 2, wherein the fill tube includes an upper surface portion and a lower surface portion, said vents being formed in the upper surface portion.

4. The ice maker assembly of claim 1, further comprising: a plurality of cross ribs alternating with the plurality of vents axially along the fill tube.

5. The ice maker assembly of claim 1, wherein the fill tube has an upper portion and a bottom portion, said bottom portion being solid to allow water to flow through the fill tube, said vents being defined along the upper portion of the fill tube.

6. A refrigerator freezer comprising:

an outer wall spaced apart from an inner wall, said inner wall being formed with an opening; and

an ice maker assembly including:

a mold cavity for collecting liquid to be frozen; and
a liquid fill tube for transporting liquid to the mold cavity, wherein the liquid fill tube extends through the opening in the inner wall, said fill tube being formed with a plurality of axially spaced vents for a ventilating flow of air.

7. The refrigerator freezer of claim 6, wherein the liquid fill tube is formed with a clearance between said inner wall and said liquid fill tube.

8. The refrigerator freezer of claim 6, wherein each of said vents takes the form of a slot.

9. The refrigerator freezer of claim 8, wherein the fill tube includes an upper surface portion and a lower surface portion, said vents being formed in the upper surface portion.

10. The refrigerator freezer of claim 6, wherein said inner wall constitutes an evaporator coil cover.

11. The refrigerator freezer of claim 6, wherein said outer wall constitutes an insulated wall of a freezer liner.

12. A method of preventing ice from forming in an ice maker fill tube of a refrigerator comprising the steps of:

generating a flow of warm air in a plenum located between an inner wall, which is formed with an opening, and an outer wall of a refrigerator freezer compartment by running a defrost cycle in the refrigerator; and

warming the fill tube, that extends through the plenum and the opening in the inner wall, by allowing the warm air to enter at least one hole formed within the fill tube.

13. The method of claim 12, further comprising: allowing the warm air to enter any one of a plurality of axially spaced holes formed along an upper surface portion of the fill tube.

* * * * *

EXHIBIT 7



US007316121B2

(12) **United States Patent**
Lee et al.

(10) **Patent No.:** **US 7,316,121 B2**
 (45) **Date of Patent:** **Jan. 8, 2008**

(54) **DISPENSER OF ICEMAKER IN REFRIGERATOR**

(75) **Inventors:** **Wook Yong Lee**, Gwangmyeong-si (KR); **Eui Yeop Chung**, Seoul (KR); **Seung Hwan Oh**, Seoul (KR); **Myung Ryul Lee**, Seongnam-si (KR); **Chang Ho Seo**, Seoul (KR); **Seong Jae Kim**, Ansan-si (KR); **Sung Hoon Chung**, Seoul (KR)

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(73) **Assignee:** **LG Electronics Inc.**, Seoul (KR)

EP 0449061 10/1991

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) **Appl. No.:** **10/833,009**

OTHER PUBLICATIONS

(22) **Filed:** **Apr. 28, 2004**

Japan Office Action with English Translation dated Dec. 19, 2006, Application No. 2001-159282 (4 pages).

(65) **Prior Publication Data**

US 2005/0056043 A1 Mar. 17, 2005

Primary Examiner William E. Tapolcai

(74) *Attorney, Agent, or Firm*—Fish & Richardson P.C.

(30) **Foreign Application Priority Data**

Sep. 17, 2003 (KR) 10-2003-0064503

(57) **ABSTRACT**

(51) **Int. Cl.**
F25C 5/18 (2006.01)
 (52) **U.S. Cl.** 62/344; 222/559
 (58) **Field of Classification Search** 62/344,
 62/389-390; 141/174; 222/559, 561, 526,
 222/504, 530, 538
 See application file for complete search history.

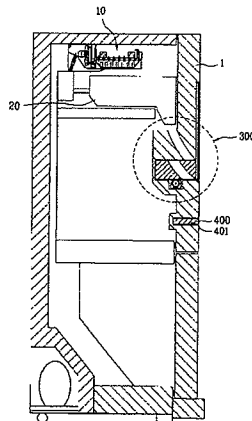
Disclosed is a dispenser of an icemaker in a refrigerator for maximizing an inner space when a total size is the same, and for minimizing the total size when the inner space is the same. The dispenser of the icemaker in the refrigerator includes an ice chute being a passage through which the ice produced from the icemaker is discharged; and a container supporter provided at an outer case and disposed to be perpendicular to an outer surface of the outer case when the ice is discharged outside through the ice chute, the container supporter allowing a container seated thereon to receive the ice discharged from the ice chute. The ice chute is closed and not exposed outside when the ice-discharging process is finished, and the container supporter is not exposed to the outer surface of the outer case.

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85 Claims, 15 Drawing Sheets



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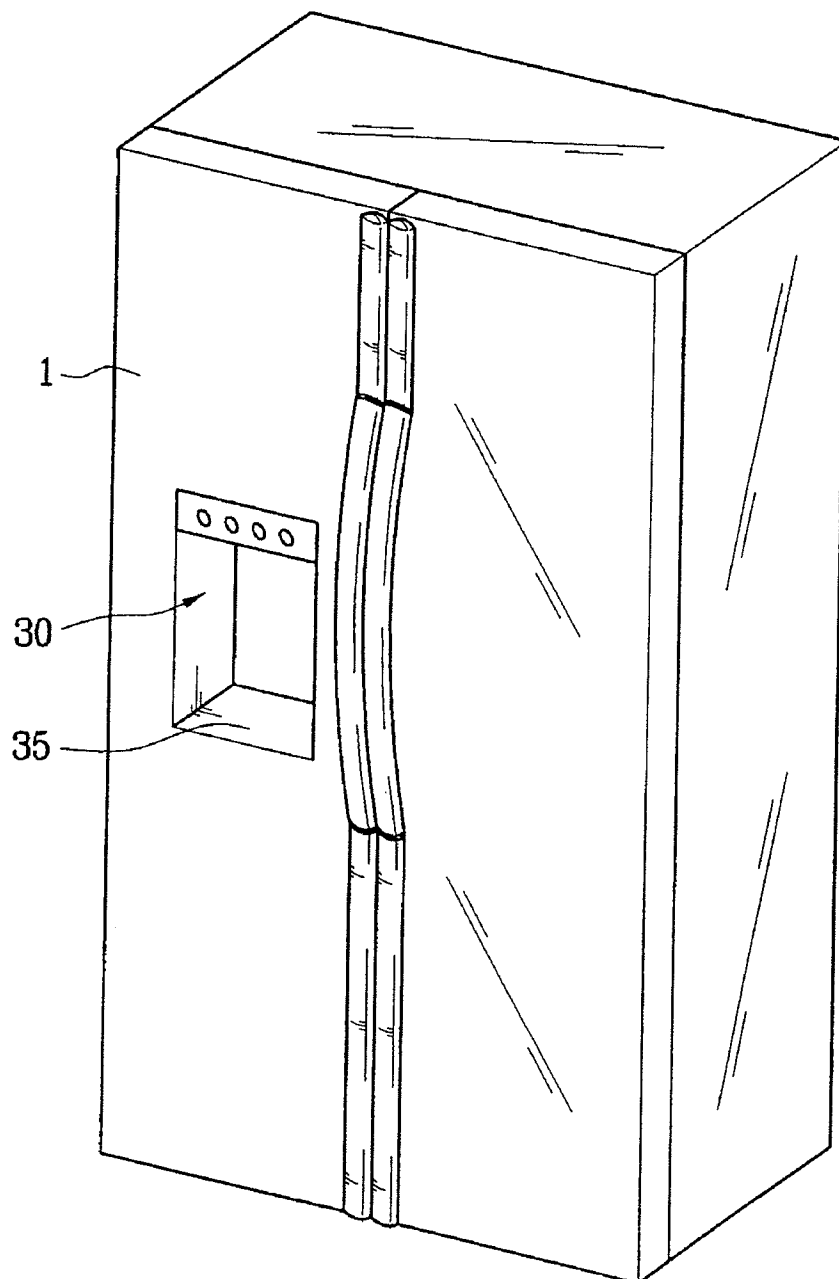
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FIG. 1
Prior Art



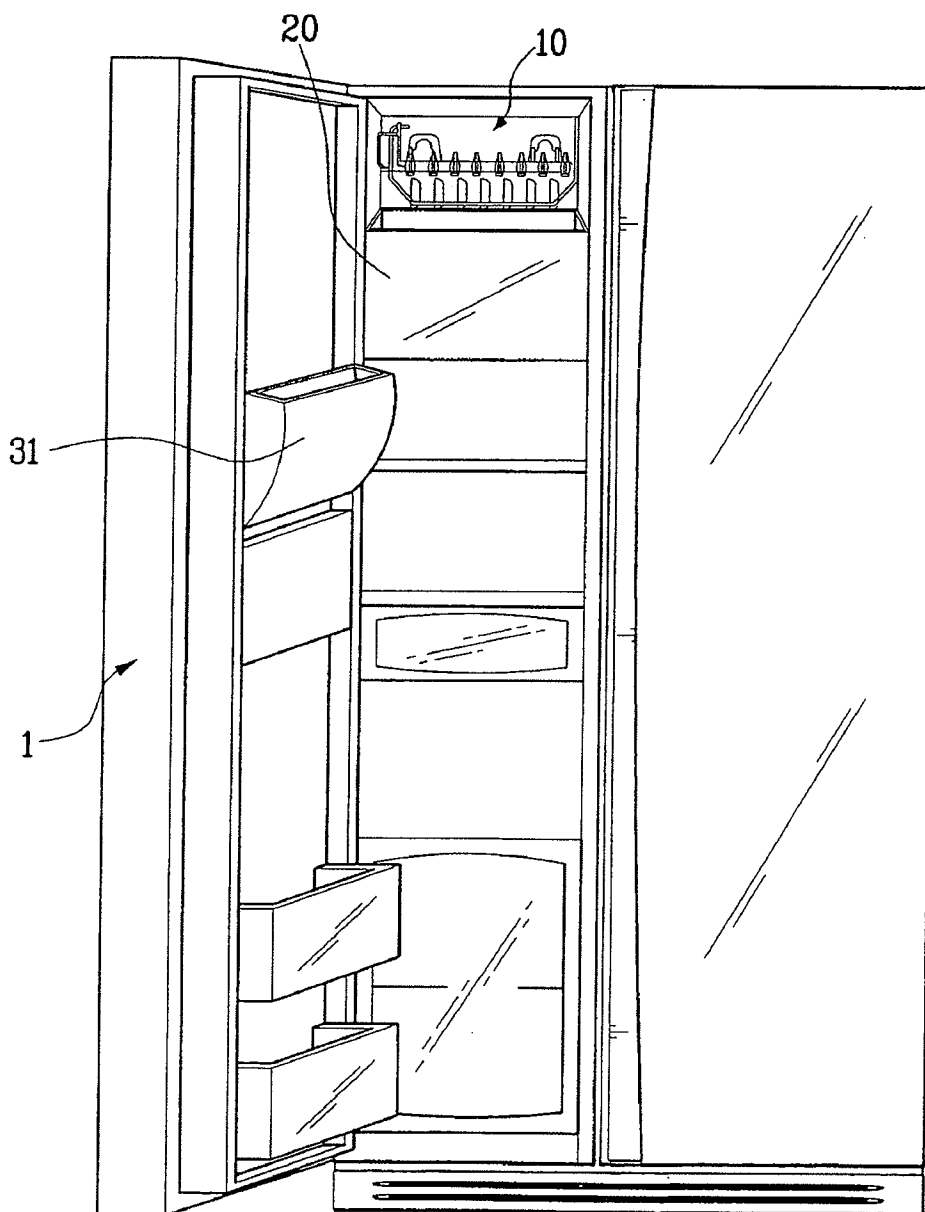
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FIG. 2
Prior Art



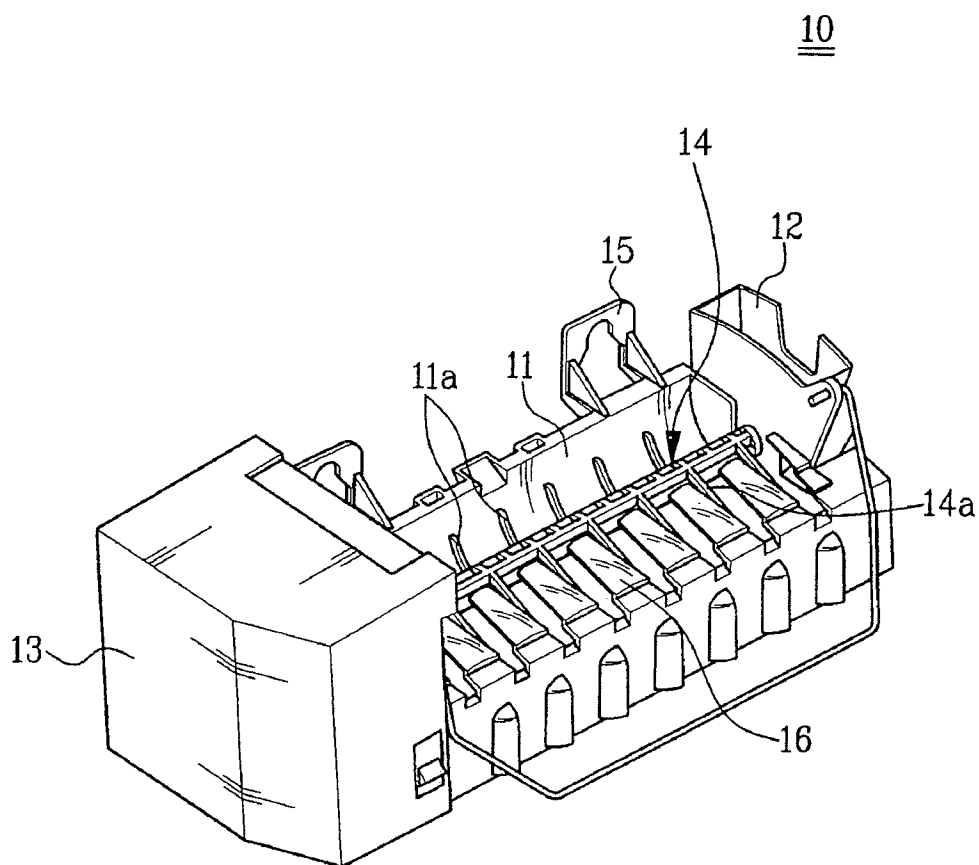
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FIG. 3
Prior Art



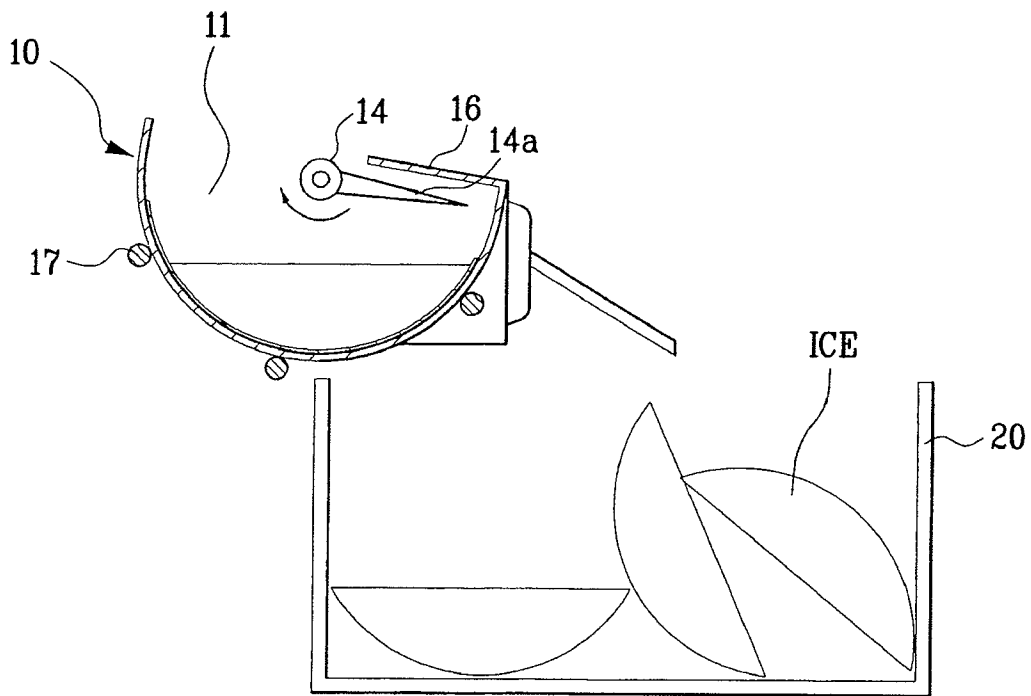
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FIG. 4
Prior Art



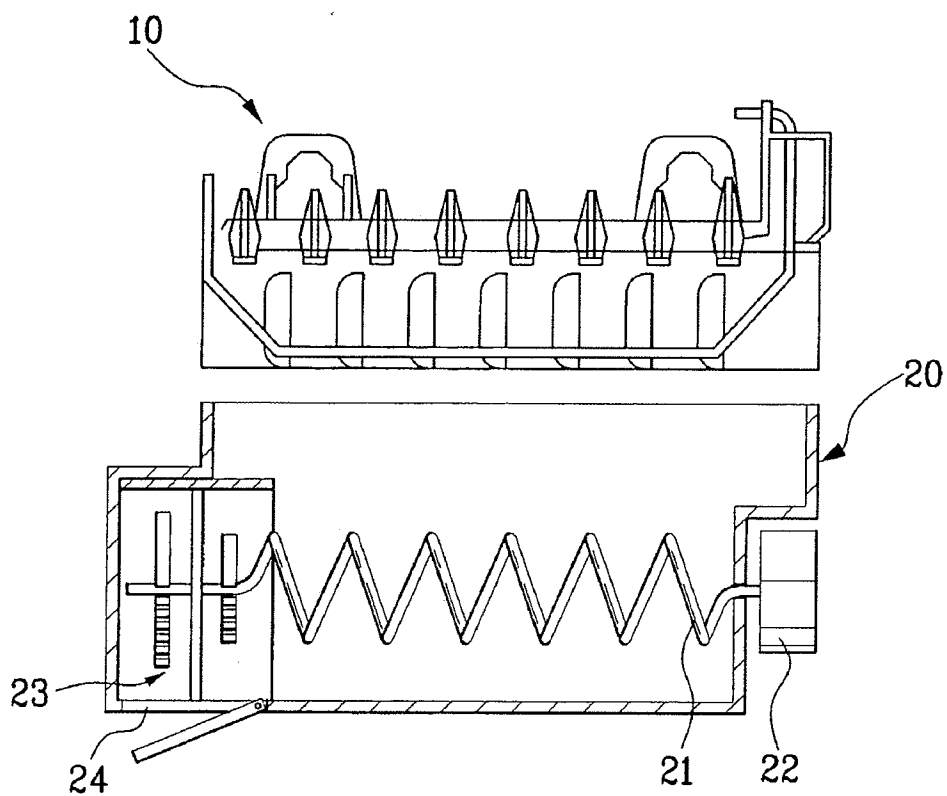
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FIG. 5
Prior Art



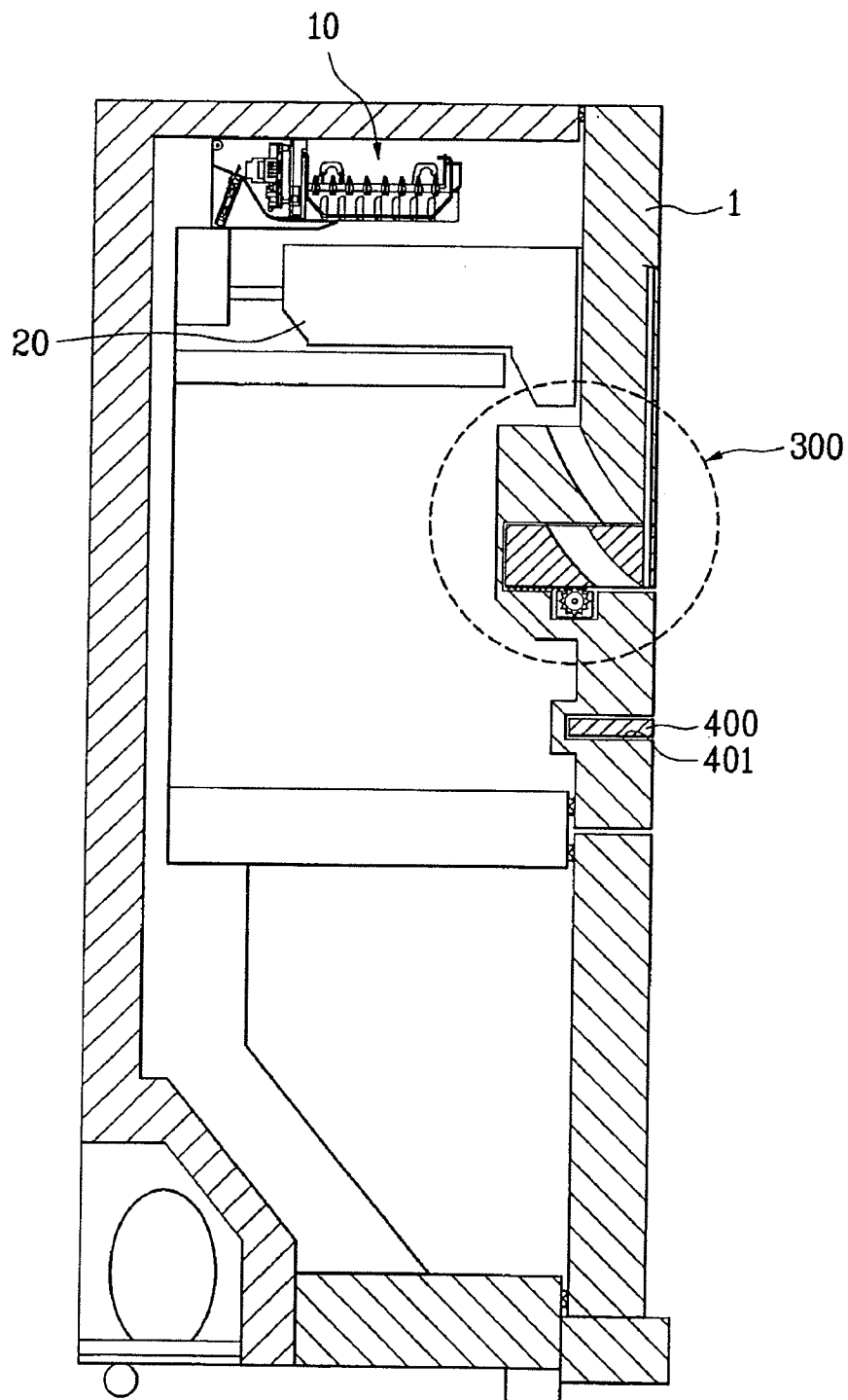
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FIG. 6



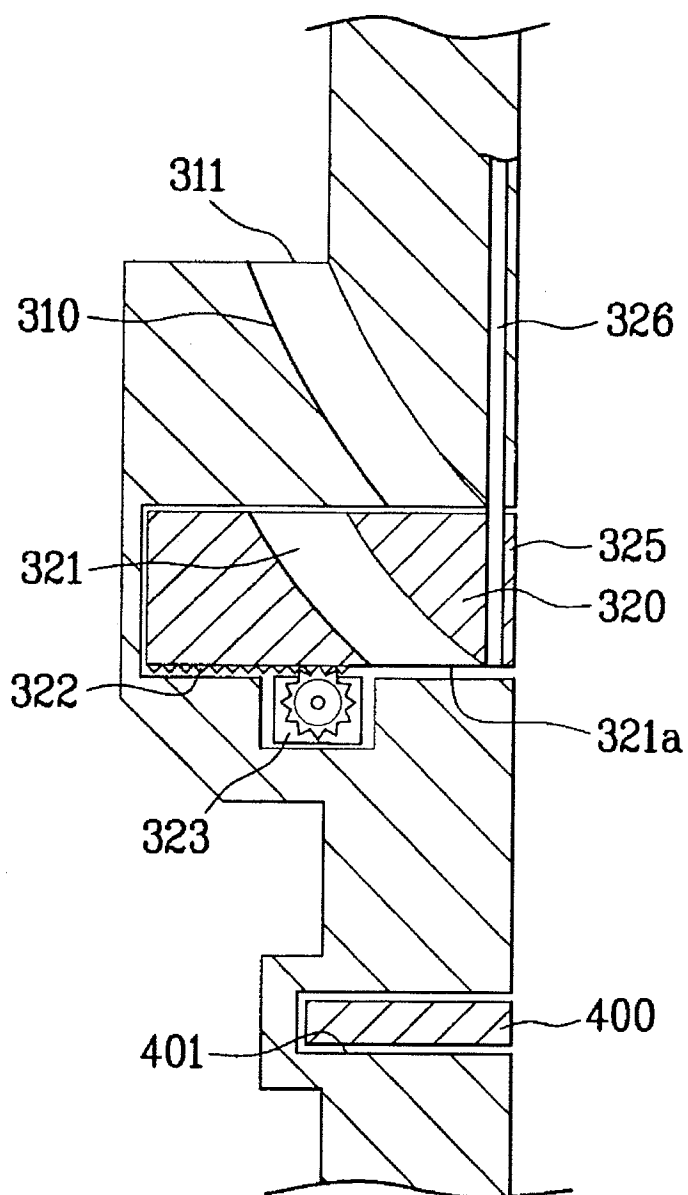
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FIG. 7



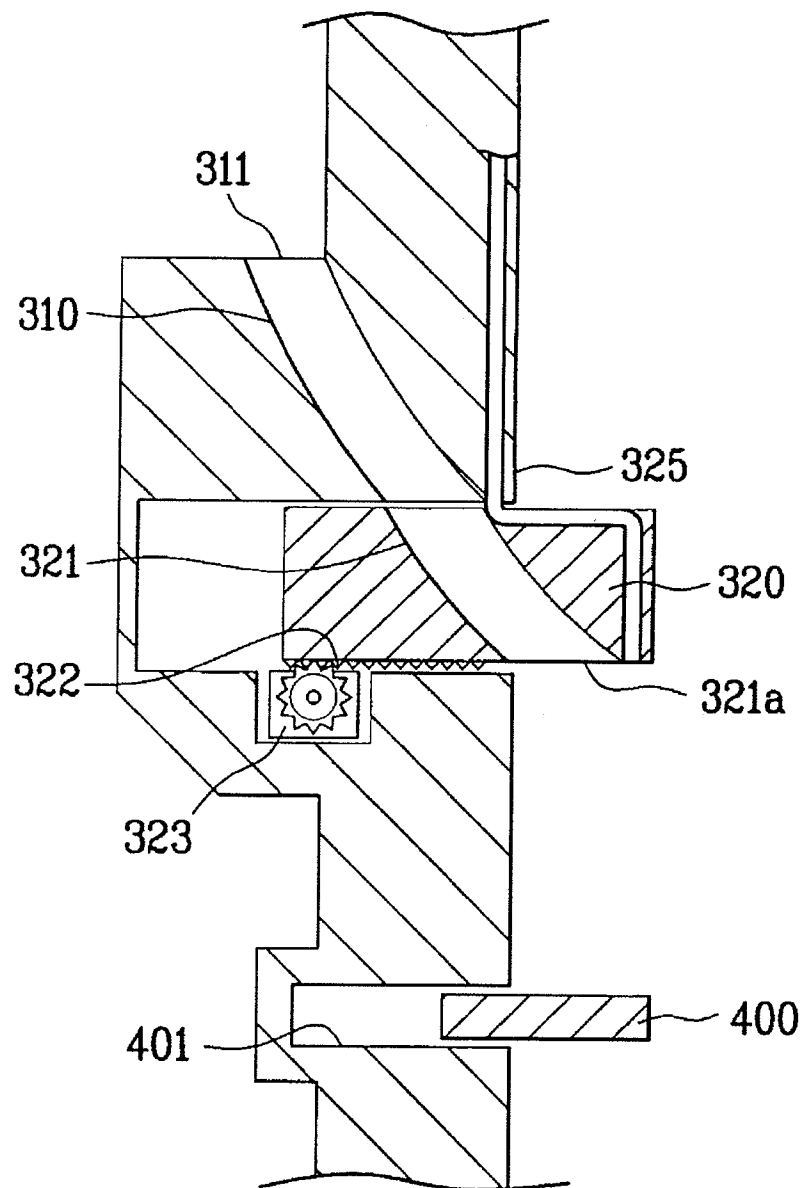
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FIG. 8



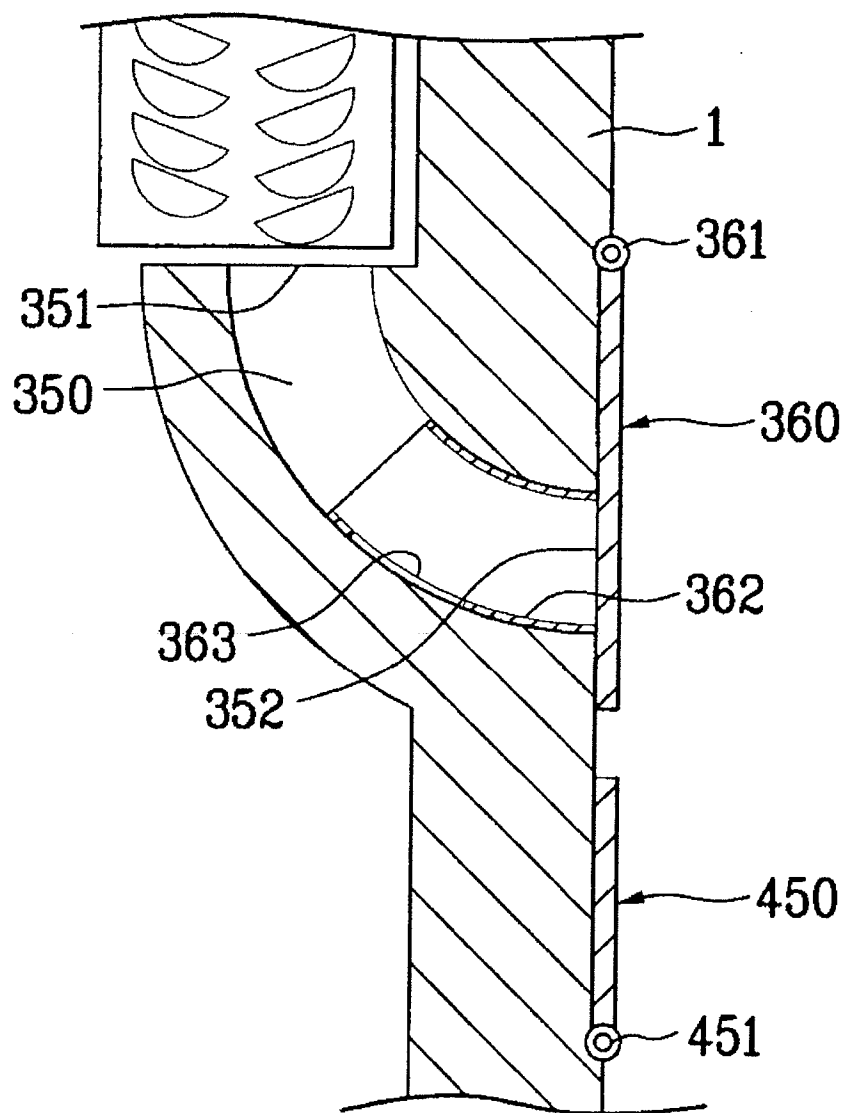
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FIG. 9



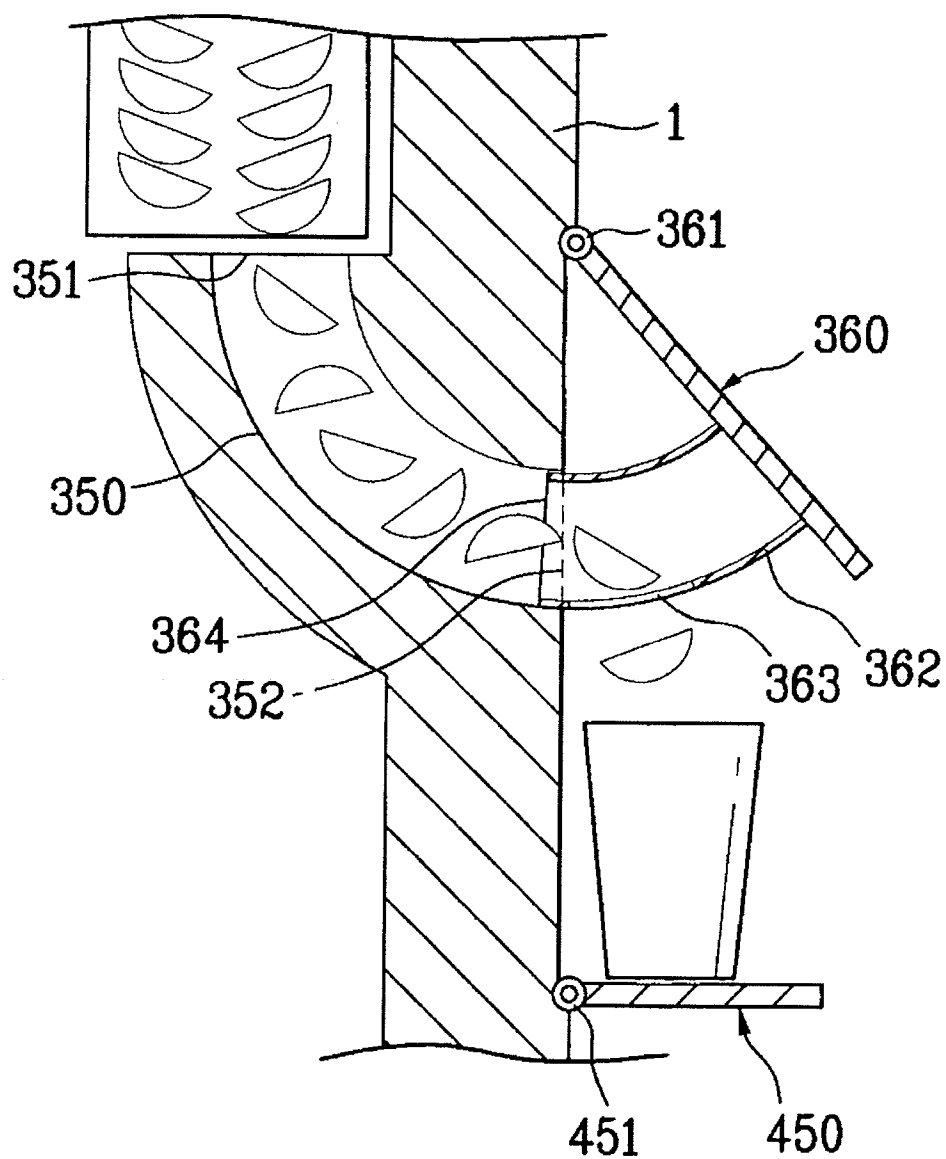
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FIG. 10



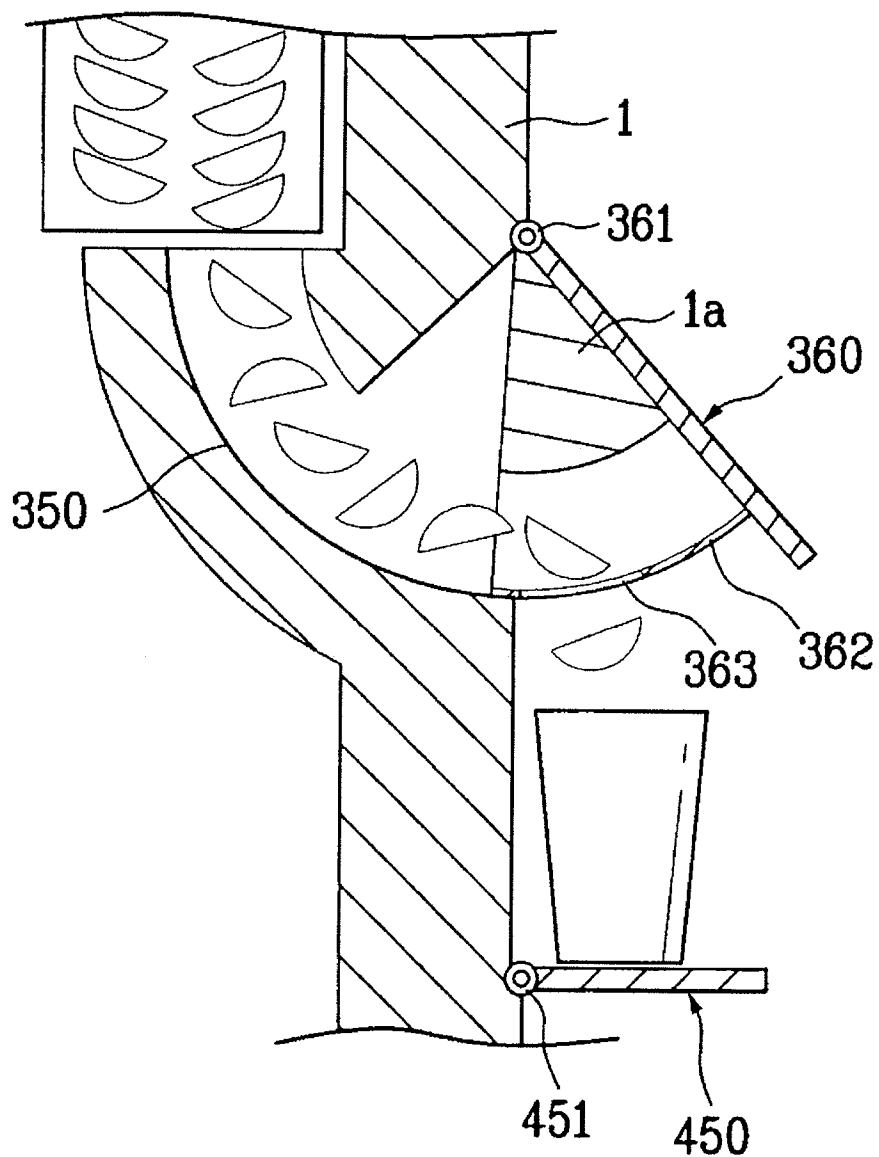
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FIG. 11



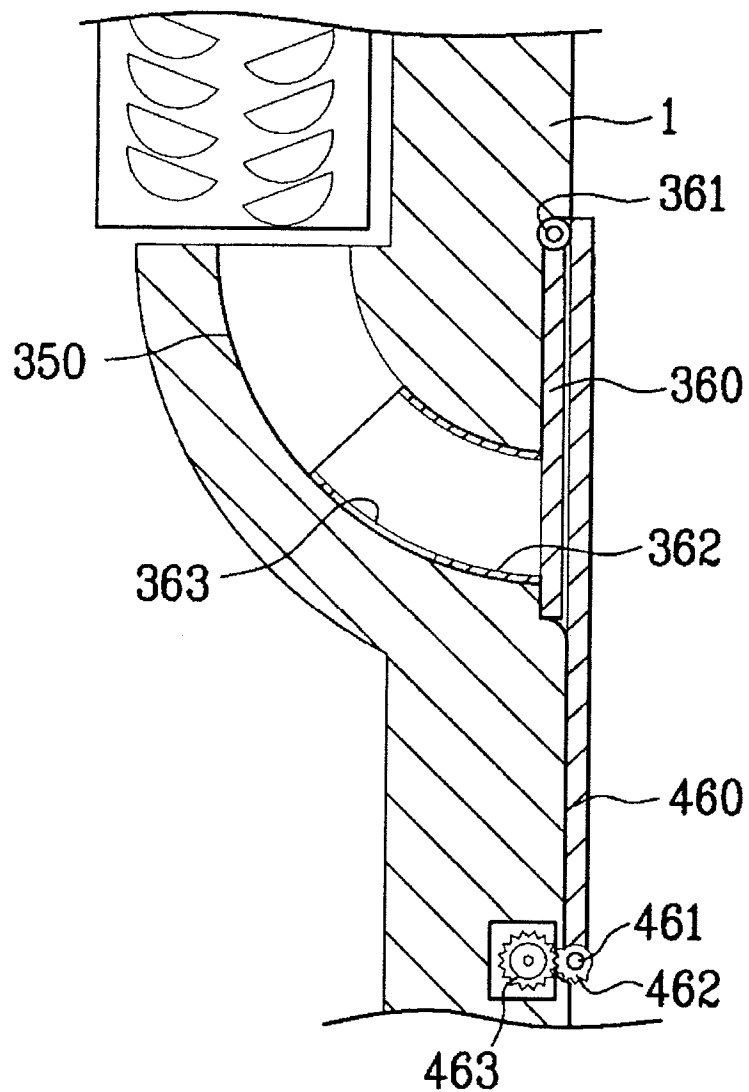
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FIG. 12



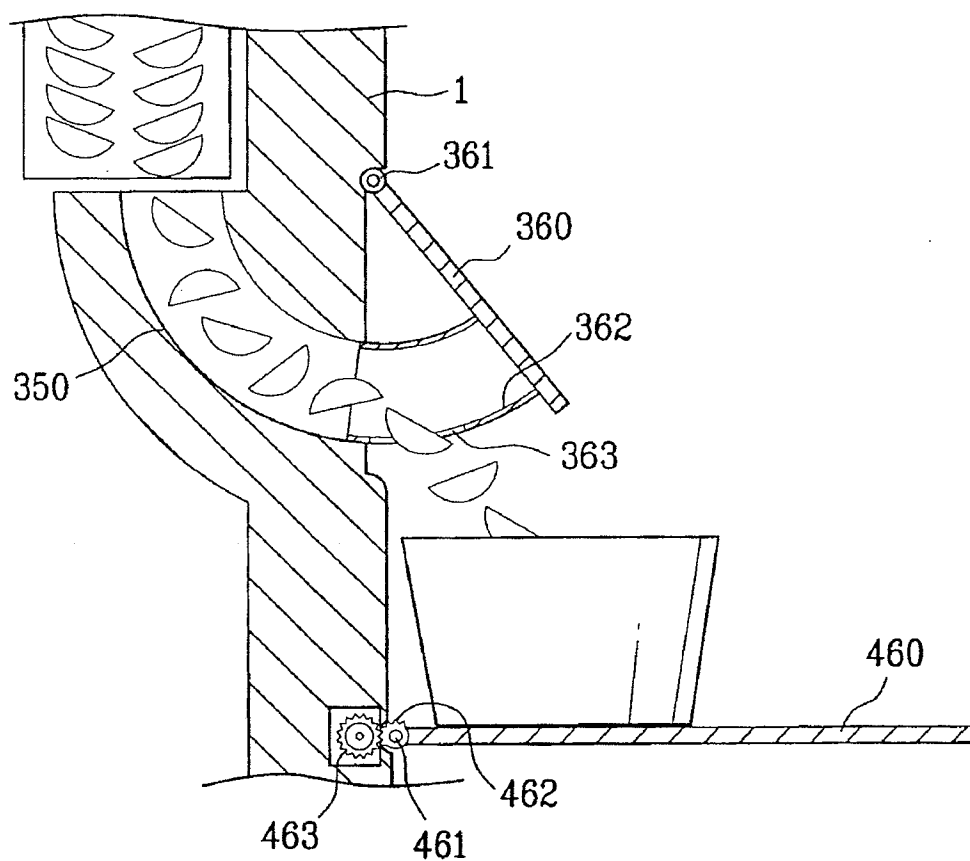
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FIG. 13



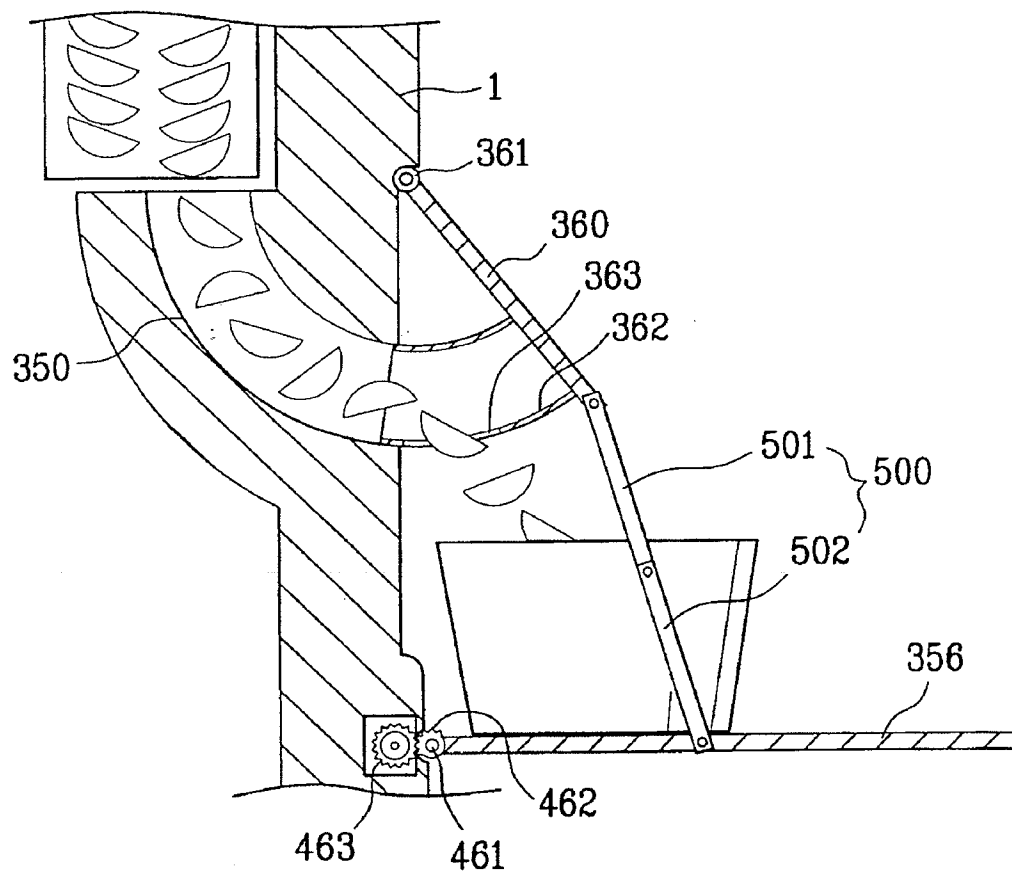
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FIG. 14A



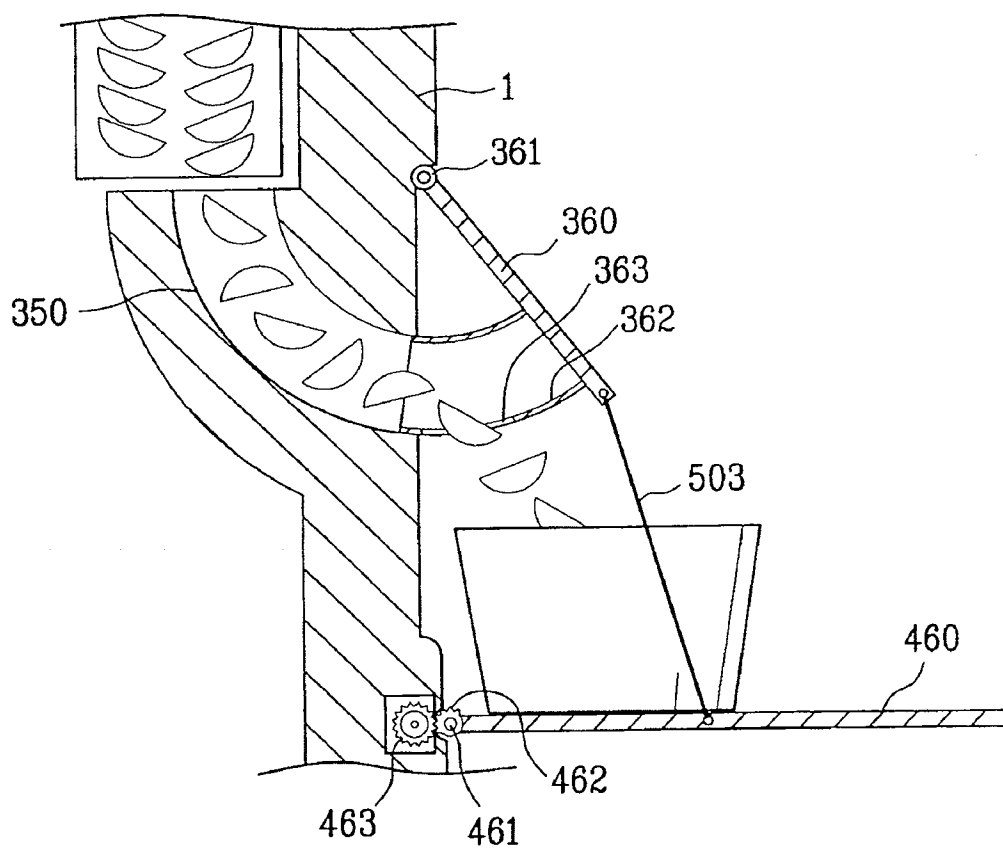
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FIG. 14B



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DISPENSER OF ICEMAKER IN REFRIGERATOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Application No. P2003-64503, filed on Sep. 17, 2003, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a dispenser of an icemaker in a refrigerator, and more particularly, to the dispenser of the ice-making apparatus with a structure for maximizing an inner space of the refrigerator.

2. Discussion of the Related Art

In general, a refrigerator is divided into a cooling chamber and a freezer. The cooling chamber keeps a temperature at about 3° C.-4° C. for keeping food and vegetables fresh for a long time. The freezer keeps a temperature at a sub-zero temperature for keeping and storing meat and fish frozen for a long time and for making and storing ice.

The recent refrigerator is developed for performing various additional functions besides a typical function thereof. The icemaker is one of the additional functions.

FIG. 1 illustrates a schematic diagram showing a conventional refrigerator. FIG. 2 illustrates a schematic diagram showing an interior of the refrigerator including a conventional ice-making apparatus. FIG. 3 illustrates a schematic diagram showing an icemaker of a conventional ice-making apparatus. FIG. 4 illustrates a diagram showing a process of discharging the ice from an icemaker. FIG. 5 illustrates an ice bank of an ice-making apparatus in the conventional refrigerator.

Referring to FIG. 1 to FIG. 5, an icemaker 10 is fixed at an upper part of the freezer in the refrigerator. The icemaker 10 is a device for freezing water and automatically discharging ice.

A structure of a conventional icemaker 10 includes an ice-making chamber 11, a water supplier 12 provided at a side of the ice-making chamber 11 for supplying water to the ice-making chamber 11, a controller 13 provided on outside of the ice-making chamber 11 and having a motor (not shown), and an ejector for discharging the ice produced from the ice-making chamber 11.

At a rear side of the ice-making chamber 10, a coupler 15 is provided for coupling the icemaker 10 with the freezer of the refrigerator.

The ice-making chamber 11 is formed in a semi-cylindrical form and having a projection 11a therein for dividing the inner space such that the ice is produced in a predetermined size.

The ejector 14 includes an axis formed to cross a center of the ice-making chamber 11 and a plurality of ejector fins 14a formed at a side of the axis of the ejector 14. The plurality of ejector fins 14a is a means of discharging the produced ice to the ice bank 20.

A sliding bar 16 is provided at a side of the plurality of ejector fins 14a for sliding the produced ice down. In more detail, the ice moved by the plurality of ejector fins 14a are placed on the sliding bar 16, then slid down along the sliding bar 16, and moved into an inside of an ice bank 20 formed at a lower part of the icemaker.

FIG. 4 illustrates a process of discharging ice from the icemaker 10 to the ice bank 20. A heater 17 is provided at

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a lower part of the ice-making chamber 11. The ice needs to be separated from a surface of the ice-making chamber for being moved. The heater 17 heats a lower surface of the ice-making chamber 11 and increases a temperature thereof for melting a surface of the ice so as to move the ice.

At a door 1 of the cooling chamber of the refrigerator, the ice bank 20 and a dispenser 30 are provided except the icemaker 10. The ice bank 20 is an apparatus for storing the ice produced from the icemaker 10 and discharging the ice when a user wants the ice to use.

Referring to FIG. 5, the ice bank 20 includes an ice remover 21, a motor 20 for rotating the ice remover, an ice crusher 23, and an ice discharger 24.

The ice remover 21 formed in a spiral form removes the ice supplied from the icemaker 10 to the ice crusher 23 when the motor 22 rotates.

The ice passed through the crusher 23 is discharged to the dispenser 30 through the ice discharger 24. The dispenser 30 includes a discharging passage 31 and a container supporter 35 provided at a lower part of the discharging passage.

The discharging passage 31 includes an inlet provided on an inner wall of the door 1, an outlet provided on an outer wall of the door 1, and a pipe for communicating the inlet with the outlet. In this case, the inlet of the discharging passage is provided at a higher place than the outlet.

The container supporter 35 is provided at a lower part of the discharging passage. In more detail, a vertical plane provided on the outer wall of the door at a lower part of the outlet of the discharging passage 31 includes a groove formed in a quadrilateral form.

A process of discharging the ice from the ice-making apparatus structured as aforementioned will be described as follows.

First, the icemaker being supplied with water through a water supply pipe produces the ice, and removes the ice to the ice bank provided at a lower part of the icemaker by using the ejector.

The ice bank storing the ice discharges the ice outside through the ice-discharging passage when the user wants to use the ice. The ice discharged outside is entered into a container and provided to the user, the container securely provided on the container supporter including the groove formed on the outer wall of the door.

However, the dispenser of the icemaker has following problems. First, the container supporter of the dispenser includes the groove with a predetermined depth on the outer wall of the door of the refrigerator. Accordingly, the door needs to be thicker than a predetermined thickness. The thick door takes up much of an inner space of the refrigerator. Therefore, a total size of the refrigerator is increased when the inner space of the refrigerator is made to be larger than a predetermined size.

Second, an outlet side of the discharging passage of the dispenser is exposed outside and dirt is collected thereon resulting in a problem of polluting the ice discharged outside by the dirt.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a dispenser of an icemaker in a refrigerator that substantially obviates one or more problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide an apparatus having a function of discharging ice with a dispenser of an icemaker for maximizing an inner space of the apparatus.

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Another object of the present invention is to provide an apparatus having a function of discharging ice with a dispenser of an icemaker for minimizing a total size of the dispenser.

A further object of the present invention is to provide an apparatus having a function of discharging ice with a dispenser of an icemaker for completely isolating an inside of an outer case from an outside thereof.

Additional advantages, objects, and features of the invention will be set forth in part in the description Which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a dispenser of an icemaker of the present invention includes an ice chute provided as a passage through which the ice produced from the icemaker provided inside of an outer case is discharged, and a container supporter provided at the outer case and disposed to be perpendicular to an outer surface of the outer case when the ice is discharged outside through the ice chute, the container supporter allowing a container seated thereon to receive the ice discharged from the ice chute.

The ice chute is closed and not exposed outside when the ice is not discharged. The ice chute includes a first chute having an inlet provided on an inner wall of a front surface of the outer case and a passage extended downward in a wall direction of the outer case, and a sliding member having a second chute diagonally extended, the sliding member moving forward to be perpendicular to the front surface of the outer case for communicating the second chute with the first chute when the ice is discharged, and being inserted into the outer case when the ice is not discharged.

The sliding member further includes a rack provided at a bottom surface thereof; and a pinion provided at a bottom of the rack and mated with the rack.

The dispenser of the icemaker further includes a cover having a first end coupled with a lower end of a front surface of the sliding member, and a second end extended upward and fixed on the front surface of the outer case.

Meanwhile, the ice chute includes an ice-discharging pipe having an inlet provided on an inner surface of the outer case and an outlet provided on an outer surface of the outer case, and a cover provided at the outer case for opening and closing the outlet of the ice-discharging pipe.

In this case, the cover is rotatably provided around a top end being coupled with the front surface of the outer case. The cover also includes a subsidiary pipe provided on a portion being in contact with the outlet portion of the ice-discharging pipe to be inserted into an inside of a passage on the outlet side of the ice discharging pipe.

The subsidiary pipe comprises an ice-passing hole at a lower part thereof for discharging the ice when the cover is rotated upward.

The container supporter is rotated downward to be perpendicular to the front surface of the outer case when the ice is discharged. The container supporter rotates upward and covers the cover.

The dispenser of the icemaker further includes a link member for coupling the container supporter with the cover.

The container supporter is inserted into a wall of the outer case when the ice is not discharged through the ice chute.

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The container supporter includes a rack provided at a bottom surface thereof, and a pinion provided under the rack and mated with the rack.

Contrary to the structure mentioned above, the container supporter may be provided under the ice chute and have an end being rotatably coupled with the front surface of the outer case.

The container supporter is rotated downward to be perpendicular to the front surface of the outer case when the ice is discharged. The container supporter closes the ice chute when the ice is not discharged.

The container supporter includes a rotating axis horizontally provided at an end of the outer wall of the outer case, a driven gear provided at the rotating axis, and a driving gear mated with the driven gear.

Owing to the dispenser of the icemaker with aforementioned structure, an inner space of the ice-discharging apparatus such as a refrigerator is maximized or a total size of the apparatus is minimized.

It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings;

FIG. 1 illustrates a schematic diagram showing a conventional refrigerator.

FIG. 2 illustrates a schematic diagram showing an interior of the refrigerator including a conventional ice-making apparatus.

FIG. 3 illustrates a schematic diagram showing an ice-maker of a conventional ice-making apparatus.

FIG. 4 illustrates a diagram showing a process of discharging ice from an icemaker.

FIG. 5 illustrates an ice bank of an ice-making apparatus in the conventional refrigerator.

FIG. 6 illustrates a diagram showing a refrigerator with a dispenser of an ice-making apparatus in accordance with a first embodiment of the present invention.

FIG. 7 illustrates a magnified view of a dispenser of an ice-making apparatus in accordance with a first embodiment of the present invention.

FIG. 8 illustrates a diagram showing a dispenser of an ice-making apparatus in a state of discharging ice accordance with a first embodiment of the present invention.

FIG. 9 illustrates a diagram showing a dispenser of an ice-making apparatus in accordance with a second embodiment of the present invention.

FIG. 10 illustrates a diagram showing a dispenser of an ice-making apparatus in a state of discharging ice accordance with a second embodiment of the present invention.

FIG. 11 illustrates a diagram showing a dispenser of an ice-making apparatus in a state of discharging ice accordance with a third embodiment of the present invention.

FIG. 12 illustrates a diagram showing a dispenser of an ice-making apparatus in accordance with a fourth embodiment of the present invention.

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FIG. 13 illustrates a diagram showing a dispenser of an ice-making apparatus in a state of discharging ice accordance with a fourth embodiment of the present invention.

FIGS. 14A and 14B illustrate a diagram showing a coupling material in accordance with a fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

In general, an icemaker is an apparatus for freezing supplied water in a predetermined size and discharging outside for supplying ice to a user when the user wants to use the ice. The icemaker provides crushed ice or uncrushed ice to the user in accordance with a choice of the user.

In general, a refrigerator is provided with the icemaker, however, may be provided with a drinking apparatus such as a purifier.

Hereinafter, a preferred embodiment of the dispenser discharging and supplying the ice to the user outside will be described referring to FIG. 6 and FIG. 15 in accordance with the icemaker with such function mentioned above.

Referring to FIG. 6 to FIG. 7, a first embodiment of the dispenser of the icemaker in accordance with the present invention includes an ice chute 300 provided at a door and forming a front surface of an outer case of the refrigerator, and a container supporter 400 provided at a lower part of the ice chute 300.

The ice chute 300 is a passage through which the ice produced from the icemaker is discharged. It is desirable that the passage is closed for preventing the ice from being exposed outside when the ice is not discharged.

In other words, the ice chute 300 includes an inlet through which the ice is inserted from a side of the icemaker, and an outlet through which the ice is discharged.

When the ice is not discharged, it is desirable that the outlet is closed for preventing dirt from being collected thereon.

Ice chute 300 includes a first chute 310 having an inlet 311 provided on an inner wall of the door and a passage extended bottomward in a direction of an outer wall of the door, and a sliding member 320 with a second chute 321 communicating with the first chute 310 when the ice is discharged and having an outlet 321a exposed outside.

In more detail, the sliding member 320 moves toward the front of the door and projects to be perpendicular to the front surface of the door. In this instance, the second chute 321 is communicated with the first chute 310.

When the ice is not discharged from the ice chute, the sliding member 320 is inserted into a groove formed on the outer surface of the door 1. In this case, it is desirable that the sliding member 320 is not projected toward outside of the door surface and the sliding member includes a guide rail for a smooth movement. The sliding member 320 also includes a handle on a front surface thereof for being manually inserted or ejected.

The dispenser also includes a spring or an oil pressure means (not illustrated) provided between a rear surface of the sliding member 320 and the groove for pressing a rear surface of the container supporter. The dispenser includes a binding for biding the sliding member. When the binding is released, the sliding member is ejected to a front of the door.

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If a front surface of the sliding member is pressed, the sliding member is inserted into the groove and locked by the binding.

Contrary to the above statement, the sliding member 320 can be automatically inserted and ejected. For this, the sliding member includes a rack 322 provided at a lower surface thereof, and a pinion 323 provided at a lower part of the rack 322. A motor (not illustrated) driven by a controller rotates the pinion 323.

In other words, when the user wants to use the ice and presses an ejection button provided at the controller (not illustrated), the motor rotates the pinion 323 and the rack 322 to, and projects the sliding member 320 by moving the sliding member 320 toward the front. The first chute 310 and the second chute 321 are communicated to discharge the ice. When the process for discharging the ice is finished, the motor is inversely rotated to insert the sliding member 320 into the groove so as to close the ice chute 300.

The dispenser of icemaker with a structure mentioned above, further includes a cover 325 having a first end coupled with a front lower end of the sliding member and a second end fixed on the front surface of the door 1. The cover 325 covers an external appearance of the ice chute 300 as well as prevents dirt from being collected on a top surface of the sliding member.

Is it desirable that a pipe for supplying drinking water is provided between the cover 325 and the door 1 so as to supply water in the container provided at the container supporter 400 when the user wants water or water with the ice.

At the container supporter 400, a container for receiving the discharged ice is provided at a lower part of the ice chute. The container supporter 400 is provided at the door 1 forming the front surface of the outer case, projected vertically above the front surface of the door 1 when the ice is discharged to outside through the ice chute 300.

Contrary to this, when the ice is not discharged, the container supporter is inserted into the groove 401 formed on the door. In this case, it is desirable that the container supporter is not projected to outside of the door and having a guide rail provided at the groove for smoothly moving.

In this case, the container supporter 400 includes a handle (not illustrated) on the front surface thereof so as to be inserted and ejected manually.

The dispenser also includes a spring or an oil pressure means (not illustrated) provided between a rear surface of the sliding member 320 and the groove for pressing the rear surface of the container supporter, and a binding for biding the sliding member. When the binding is released, the sliding member is ejected on the front of the door. If a front surface of the sliding member is pressed, the sliding member is inserted into the groove and locked by the binding.

Contrary to this, the container supporter can be automatically inserted or ejected. For this, the container supporter, as the sliding member, includes the rack provided at the lower surface thereof, and the pinion provided at the lower part of the rack, the pinion rotatably provided.

For this, the sliding member includes a rack 322 provided on a lower surface thereof, and a pinion provided at a lower part of the rack and mated with the rack so as to rotate together by a motor (not illustrated) driven by a controller.

In other words, when the user wants the ice and presses the ejection button, the motor rotates the pinion and the rack, and the container supporter is moved to the front and projected on the front of the door. When the ice discharging process is finished, the motor is inversely rotated to insert the sliding member 320 into the groove. In the dispenser of

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the icemaker with the structure mentioned above, it is desirable that the container supporter 410 is ejected earlier than the sliding member 320.

In other words, it is desirable that the ice is discharged after the container supporter is ejected, the container is provided on top of the container supporter, and the sliding member is ejected.

A second embodiment of the dispenser of the icemaker in accordance with the present invention will be described in reference to FIG. 9 to FIG. 10.

Referring to FIG. 9, the dispenser of the icemaker includes an ice-discharging pipe, the pipe having an inlet 351 formed on an inner surface of the door 1 of the refrigerator and an outlet 352 formed on an outer surface of the door, a cover 360 provided on the outer surface of the door for opening and closing the outlet 352, and a container supporter 450 having the container securely provided thereon for receiving the ice discharged outside through the ice-discharging pipe.

The inlet 351 is provided at an upper part of the outlet 352 for discharging the ice inserted from the icemaker by gravity. The cover 360 having a top end coupled with the door 1 of the refrigerator is rotatably provided around the top end 361.

The cover 360 also includes a subsidiary pipe 362 provided on the inner surface of the cover in contact with the outlet of the ice-discharging pipe so as to insert the ice into the inside of passage on a side of the outlet 352 of the ice-discharging pipe.

The subsidiary pipe 362 includes an ice-passing hole 363 provided at a lower part thereof in order to discharge the ice when the top cover is rotated upward.

In other words, when the cover 360 is rotated, the ice-passing hole 363 of the subsidiary pipe 362 is exposed to the outside of the ice-discharging pipe 350 and the ice is discharged. In this instance, an end 364 of the subsidiary pipe is not exposed to the outside of the ice-discharging pipe.

Although the user can manually opens and closes the cover 360, the outlet of the ice-discharging pipe is automatically opened and closed in accordance with the second embodiment.

Meanwhile, the container supporter 450 is provided at the lower part of the cover and has an end rotatably coupled with the front surface of the refrigerator.

When the ice is discharged, the container supporter 450 is rotated downward around the lower end 451 to be projected vertically on the front surface of the door 1.

When the ice is not discharged, the container supporter is rotated upward around the lower end 451 to be in contact with the front surface of the door.

Although not illustrated, in the present embodiment, the container supporter and the cover are formed in a semicircular form for an external appearance.

It is desirable that grooves formed in same forms as the cover and the container supporter are provided on the outer wall of the door such that the container supporter and the cover are not projected on the front surface of the door when the ice is not discharged. In the mean time, when the ice is not discharged, it is not the cover but the container supporter directly opening and closing the ice chute.

The container supporter 450 automatically rotates and includes a rotating axis provided horizontally at an end coupled with the outer wall of the outer case, a driven gear provided at the rotating axis, and a driving gear coupled with the driven gear. The structure will be described again in describing a fourth embodiment of the present invention.

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The motor operated by the controller (not illustrated) rotates the driving gear. The rotating method is applicable to a rotation of the cover 360.

Contrary to the above statement, a portion 1a located at an inside of the cover on the outer wall of the door and the cover 360 are formed as a single body, and the top portion of the subsidiary pipe 362 includes the portion 1a on the outer wall of the door, the portion 1a integrated with the cover 360.

The dispenser of the icemaker with the structure mentioned above is a third embodiment illustrated in FIG. 11. In accordance with the third embodiment of the present invention, the other components except the structure of the third embodiment is the same as the second embodiment and it will be omitted.

Meanwhile, the container supporter 460 covers the cover 360 as illustrated in FIG. 12 to FIG. 14. The structure mentioned above is a fourth embodiment. In accordance with the present invention, all other compositions except the components explained below are the same as the second and the third embodiments.

In accordance with the present invention, as illustrated in FIG. 14, the dispenser of the icemaker includes a link member 500 coupling the container supporter 460 and the cover 360.

The link member 500 has a first end coupled with the lower side of the cover 360 and a second end coupled with a side of the container supporter 460. For this, the link member includes a top coupler 501 rotatably coupled with the lower side of the cover, and a bottom coupler 502 having a first end rotatably coupled with a second end of the top coupler and a second end rotatably coupled with the lower side of the container supporter.

Contrary to the above statement, the link member 500 may include a soft string 503. The link member 500 becomes parallel to the cover for supporting weight of the container supporter having the container when the container supporter is rotated downward to be perpendicular to the outer wall of the outer case for discharging the ice.

The container supporter 460 is automatically rotated. For this, the container supporter 460 includes a rotating axis 461 provided horizontally at an end coupled with the outer wall of the outer case, a driven gear 462 provided at the rotating axis, and a driving gear 463 mated with the driven gear for driving the driven gear.

The dispenser of the icemaker with the structure mentioned above is operated as follows. First, when the user wants the ice and presses the ejection button of the controller, the container supporters (400, 450, 460) are provided to be perpendicular to the front surface of the door of the refrigerator.

For this, the container supporter 400 in the first embodiment of the present invention is withdrawn to the front surface of the door by the rotation of the pinion and the container supporters 450 and 460 in the second and fourth embodiments are rotated downward by the driving gear to be perpendicular to the front surface of the door.

Next, when the ice chute 300 and 350 are opened, the ice is discharged outside and received into the container provided on top of the container supporter. Then, the user takes the ice to put in a beverage or in food. The opening process of the ice chute is described above and a detailed description will be omitted.

When the ice is discharged as much as the user needs, the container supporter is inserted into the inside of the groove provided at the door or is rotated upward by the driving gear, and adhered to the front surface of the door to be horizontal

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thereto in accordance with the present embodiment. Then, the container supporter or the cover closes the outlet of the ice chute.

Effects of the present invention with above mentioned structure is summarized as follows. First, a space taken by the container supporter or the ice chute is minimized and an inner space of the refrigerator or an apparatus with an ice-discharging function is maximized in accordance with the present invention.

Second, the space taken by the container supporter of the ice chute is minimized and the total size of the refrigerator or the apparatus with an ice-discharging function is minimized in accordance with the present invention.

Third, the outlet of the ice chute provided on the ice discharging passage is completely closed when the ice is not discharged in order to prevent the dirt from being collected on the passage in accordance with the present invention.

Fourth, the external appearance is improved because the ice chute and the container supporter are not projected outside or caved-in in accordance with the present invention.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A dispenser for an appliance comprising:
 - a water dispensing assembly comprising a chute through which water is discharged; and
 - a container support provided at an outer casing and configured to be perpendicular to an outer surface of the outer casing when water is discharged through the chute, the container support being configured to allow a container received thereon to receive water discharged through the chute, wherein the container support is retractable into a wall of the outer casing.
2. The dispenser of claim 1, wherein the container support comprises:
 - a rack provided at a bottom surface of the container support; and
 - a pinion provided beneath the rack and engaged with the rack.
3. The dispenser of claim 2 further comprising a motor configured to rotate the pinion to move the container support by engagement of the rack and pinion.
4. The dispenser of claim 1 wherein the container support and at least a portion of the water dispensing assembly are configured for coordinated movement between advanced and retracted positions.
5. The dispenser of claim 1 further comprising a motor configured to move the container support.
6. The dispenser of claim 1 wherein the water dispensing assembly is configured to dispense liquid.
7. The dispenser of claim 1 wherein the water dispensing assembly is configured to dispense ice.
8. The dispenser of claim 1 wherein the water dispensing assembly is configured to dispense liquid and ice simultaneously.
9. The dispenser of claim 1 wherein the water dispensing assembly is configured to dispense water irrespective of a position of the container support.
10. A dispenser for an appliance comprising:
 - a water dispensing assembly configured to move, such that an outlet of the water dispensing assembly is

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positioned outside an outer surface of a door of an appliance in at least one position of water dispensing assembly movement; and

a container support configured to extend along a plane perpendicular to the door such that the container support is configured for movement between a withdrawn and an extended position, the container support being configured to, in the extended position, support a container being filled by the water dispensing assembly when the outlet of the water dispensing assembly is positioned outside an outer surface of the door.

11. The dispenser of claim 10 further comprising:

a first mechanical drive mechanism configured to move the water dispensing assembly; and

a second mechanical drive mechanism configured to extend the container support along a plane perpendicular to the door between the withdrawn and extended positions,

wherein the second mechanical drive mechanism is configured to extend the container support along a plane perpendicular to the door prior to the first mechanical drive mechanism moving the water dispensing assembly to a position at which the outlet of the water dispensing assembly is positioned outside an outer surface of the door.

12. The dispenser of claim 11 wherein the first mechanical drive mechanism and the second mechanical drive mechanism are activated by a single input device.

13. The dispenser of claim 10 wherein the movement of the water dispensing assembly is independent from the movement of the container support.

14. The dispenser of claim 10 further comprising a mechanical drive mechanism configured to extend the container support along a plane perpendicular to the door between the withdrawn and extended positions.

15. The dispenser of claim 14 wherein the mechanical drive mechanism includes a spring.

16. The dispenser of claim 14 wherein the mechanical drive mechanism includes an oil pressure assembly.

17. The dispenser of claim 14 wherein the mechanical drive mechanism includes a motor.

18. The dispenser of claim 17 wherein the container support includes a rack and the motor is configured to rotate a pinion mated with the rack.

19. The dispenser of claim 14 wherein the mechanical drive mechanism is configured to retract the container support along a plane perpendicular to the door between the withdrawn and extended positions.

20. The dispenser of claim 10 further comprising a mechanical drive mechanism configured to move the water dispensing assembly.

21. The dispenser of claim 20 wherein the mechanical drive mechanism includes a spring.

22. The dispenser of claim 20 wherein the mechanical drive mechanism includes an oil pressure assembly.

23. The dispenser of claim 20 wherein the mechanical drive mechanism includes a motor.

24. The dispenser of claim 23 wherein the water dispensing assembly includes a rack and the motor is configured to rotate a pinion mated with the rack.

25. The dispenser of claim 10 wherein the outlet of the water dispensing assembly is not exposed when the outlet of the water dispensing assembly is positioned inside an outer surface of the door.

26. The dispenser of claim 10 wherein the water dispensing assembly is configured to dispense liquid.

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27. The dispenser of claim 10 wherein the water dispensing assembly is configured to dispense ice.

28. The dispenser of claim 10 wherein the water dispensing assembly includes a sliding member and an end portion of a water supply pipe attached to the sliding member.

29. The dispenser of claim 28 wherein the water supply pipe extends when the outlet of the water dispensing assembly is positioned outside an outer surface of the door.

30. The dispenser of claim 10 wherein the water dispensing assembly includes a sliding member and an ice chute.

31. The dispenser of claim 30 wherein the ice chute communicates with a second ice chute extending from an icemaker when the outlet of the water dispensing assembly is positioned outside an outer surface of the door, the second ice chute and the icemaker remaining inside the outer surface of the door.

32. The dispenser of claim 10 wherein the outlet of the water dispensing assembly includes an outlet of a water supply pipe.

33. The dispenser of claim 10 wherein the outlet of the water dispensing assembly includes an outlet of an ice chute.

34. The dispenser of claim 10 wherein the water dispensing assembly is configured to move about a plane perpendicular to the door of the appliance.

35. The dispenser of claim 10 wherein the water dispensing assembly is configured to dispense liquid and ice simultaneously.

36. A dispenser for an appliance comprising:

a movable member;

a water supply mechanism attached to the movable member; and

a mechanical drive mechanism configured to, upon activation of a user control, apply force other than supplied by a user to motivate movement of the movable member from a first position at which an outlet of the water supply mechanism is positioned behind a plane representing an outer surface of a door of an appliance to a second position at which the outlet of the water supply mechanism is positioned in front of the plane representing the outer surface of the door.

37. The dispenser of claim 36 wherein the mechanical drive mechanism includes a spring.

38. The dispenser of claim 36 wherein the mechanical drive mechanism includes an oil pressure assembly.

39. The dispenser of claim 36 wherein the mechanical drive mechanism includes a motor.

40. The dispenser of claim 39 wherein the movable member includes a rack and the motor is configured to rotate a pinion mated with the rack.

41. The dispenser of claim 36 further comprising a container support configured to extend along a plane perpendicular to the door.

42. The dispenser of claim 41 wherein the container support in an extended position is configured to support a container being filled when the movable member is in the second position.

43. The dispenser of claim 36 wherein the water supply mechanism is configured to dispense liquid.

44. The dispenser of claim 36 wherein the water supply mechanism is configured to dispense ice.

45. The dispenser of claim 36 wherein the water supply mechanism is configured to dispense liquid and ice simultaneously.

46. The dispenser of claim 36 wherein the outlet of the water supply mechanism includes an outlet of a water supply pipe.

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47. The dispenser of claim 36 wherein the outlet of the water supply mechanism includes an outlet of an ice chute.

48. The dispenser of claim 36 wherein the mechanical drive mechanism is configured to apply force to the movable member to motivate movement of the movable member about a plane perpendicular to the door of the appliance.

49. A dispenser for an appliance comprising:

a water dispensing assembly;

first moving means for moving the water dispensing assembly between a position at which an outlet of the water dispensing assembly is positioned outside an outer surface of a door of an appliance and at least one another position;

a container support; and

second moving means for moving the container support along a plane perpendicular to the door between a withdrawn and an extended position,

the container support configured to support a container being filled by the water dispensing assembly when the first moving means moves the water dispensing assembly to the position at which the outlet of the water dispensing assembly is positioned outside the outer surface of the door of the appliance and the second moving means moves the container support to the extended position.

50. The dispenser of claim 49 wherein the second moving means moves the container support to the extended position prior to the first moving means moving the water dispensing assembly to the position at which the outlet of the water dispensing assembly is positioned outside the outer surface of the door of the appliance.

51. The dispenser of claim 49 further comprises a single user input for activating the first moving means and the second moving means.

52. The dispenser of claim 49 wherein the movement of the first moving means is independent from the movement of the second moving means.

53. The dispenser of claim 49 wherein the water dispensing assembly dispenses liquid.

54. The dispenser of claim 49 wherein the water dispensing assembly dispenses ice.

55. The dispenser of claim 49 wherein the water dispensing assembly dispenses liquid and ice simultaneously.

56. The dispenser of claim 49 wherein the first moving means moves the water dispensing assembly about a plane perpendicular to the door of the appliance.

57. A dispenser for an appliance comprising:

a movable member;

a water supply mechanism attached to the movable member; and

a user input for enabling activation of the user input, applying a force to motivate movement of the movable member from a first position at which an outlet of the water supply mechanism is positioned behind a plane representing an outer surface of a door of an appliance to a second position at which the outlet of the water supply mechanism is positioned in front of the plane representing the outer surface of the door, the force applied by the positioning means being other than the force input by the user to the user input.

58. The dispenser of claim 57 further comprising a container support.

59. The dispenser of claim 58 further comprising means for moving the container support along a plane perpendicular to the door.

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60. The dispenser of claim 59 wherein the container support supports a container being filled when the movable member is moved by the positioning means to the second position.

61. The dispenser of claim 57 wherein the water supply mechanism dispenses liquid.

62. The dispenser of claim 57 wherein the water supply mechanism dispenses ice.

63. The dispenser of claim 57 wherein the water supply mechanism dispenses liquid and ice simultaneously.

64. The dispenser of claim 57 wherein the positioning means applies force to motivate movement of the movable member about a plane perpendicular to the door of the appliance.

65. A method of filling a container with water using a dispenser of an appliance, the method comprising:

extending a container support along a plane perpendicular to a door of an appliance from a withdrawn position to an extended position;

placing a container on the container support when the container support is in the extended position;

moving a water dispensing assembly to a position at which an outlet of the water dispensing assembly is outside of an outer surface of the door of the appliance; and

enabling the water dispensing assembly to dispense water into the container.

66. The method of filling a container of claim 65 wherein extending a container support along a plane perpendicular to a door of an appliance from a withdrawn position to an extended position includes manually moving the container support along the plane perpendicular to the door of the appliance from the withdrawn position to the extended position.

67. The method of filling a container of claim 65 wherein extending a container support along a plane perpendicular to a door of an appliance from a withdrawn position to an extended position includes activating an input device to cause a mechanical drive mechanism to move the container support along the plane perpendicular to the door of the appliance from the withdrawn position to the extended position.

68. The method of filling a container of claim 67 wherein by activating the input device to cause the mechanical drive mechanism to move the container support, a force is generated in excess of a force applied by a user.

69. The method of filling a container of claim 65 wherein moving a water dispensing assembly includes manually moving the water dispensing assembly.

70. The method of filling a container of claim 65 wherein moving a water dispensing assembly includes activating an input device to cause a mechanical drive mechanism to move the water dispensing assembly.

71. The method of filling a container of claim 70 wherein by activating the input device to cause the mechanical drive mechanism to move the water dispensing assembly, a force is generated in excess of a force applied by a user.

72. The method of filling a container of claim 65 wherein extending a container support along a plane perpendicular to a door of an appliance from a withdrawn position to an extended position and moving a water dispensing assembly include activating a single input device to cause a first mechanical drive mechanism to move the container support and a second mechanical drive mechanism to move the water dispensing assembly.

73. The method of filling a container of claim 72 wherein the first mechanical drive mechanism is configured to move

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the container support prior to the second mechanical drive mechanism moving the water dispensing assembly.

74. The method of filling a container of claim 65 wherein enabling the water dispensing assembly to dispense water into the container includes enabling the water dispensing assembly to dispense liquid into the container.

75. The method of filling a container of claim 65 wherein enabling the water dispensing assembly to dispense water into the container includes enabling the water dispensing assembly to dispense ice into the container.

76. The method of filling a container of claim 65 wherein enabling the water dispensing assembly to dispense water into the container includes enabling the water dispensing assembly to dispense liquid and ice into the container simultaneously.

77. The method of filling a container of claim 65 wherein extending a container support along a plane perpendicular to a door of an appliance from a withdrawn position to an extended position is performed before moving a water dispensing assembly to a position at which an outlet of the water dispensing assembly is outside of an outer surface of the door of the appliance.

78. The method of filling a container of claim 65 wherein extending a container support along a plane perpendicular to a door of an appliance from a withdrawn position to an extended position is performed after moving a water dispensing assembly to a position at which an outlet of the water dispensing assembly is outside of an outer surface of the door of the appliance.

79. The method of filling a container of claim 65 wherein placing a container on the container support when the container support is in the extended position is performed before moving a water dispensing assembly to a position at which an outlet of the water dispensing assembly is outside of an outer surface of the door of the appliance.

80. The method of filling a container of claim 65 wherein placing a container on the container support when the container support is in the extended position is performed after moving a water dispensing assembly to a position at which an outlet of the water dispensing assembly is outside of an outer surface of the door of the appliance.

81. The method of filling a container of claim 65 further comprising retracting the container support along the plane perpendicular to the door of the appliance from the extended position to the withdrawn position.

82. The method of filling a container of claim 65 further comprising moving the water dispensing assembly to a position at which an outlet of the water dispensing assembly is inside of the outer surface of the door of the appliance.

83. A method of manufacturing a dispenser for an appliance, the method comprising:

attaining a water dispensing assembly;

configuring the water dispenser assembly with an outlet that is positioned outside of an outer surface of a door of an appliance and that is movable between at least two water dispensing positions;

attaining a container support; and

configuring the container support to extend along a plane perpendicular to the door such that the container support is configured for movement between a withdrawn and an extended position, the container support being configured to, in the extended position, support a container being filled by the water dispensing assembly when the outlet of the water dispensing assembly is positioned outside an outer surface of the door.

84. A method of manufacturing a dispenser for an appliance, the method comprising:

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attaining a movable member;
attaining a water supply mechanism;
attaching the water supply mechanism to the movable member;
attaining a mechanical drive mechanism;
attaining a user control; and
configuring the mechanical drive mechanism to, upon
activation of the user control, apply a force other than
supplied by a user to motivate movement of the movable member from a first position at which an outlet of
the water supply mechanism is positioned behind a

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plane representing an outer surface of a door of an
appliance to a second position at which the outlet of the
water supply mechanism is positioned in front of the
plane representing the outer surface of the door.

85. The method of manufacturing a dispenser for an
appliance of claim 84 wherein the mechanical drive mechanism applies a force greater than a force imparted by a user activating the user control.

* * * * *

EXHIBIT 8



US006834922B2

(12) **United States Patent**
Cho

(10) **Patent No.:** **US 6,834,922 B2**

(45) **Date of Patent:** **Dec. 28, 2004**

(54) **VEGETABLE COMPARTMENT IN REFRIGERATOR**

(75) **Inventor:** **Seok Hyun Cho, Changwon-shi (KR)**

(73) **Assignee:** **LG Electronics Inc., Seoul (KR)**

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(52) **U.S. Cl.** **312/331; 312/330.1; 312/408**

(58) **Field of Search** **312/330.1, 333, 312/295, 310, 401, 402, 408, 331**

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(57) **ABSTRACT**

A refrigerator compartment having a drawer-type container includes an opening in a top side thereof, and a first rail at a side surface thereof having sloped and horizontal parts. A partition member on the container has a first plate, a second plate, and a link member. The second plate covers an area of the opening of the container, and the first plate is connected to the second plate such that the first plate can pivot relative to the second plate. The link member extends from the first plate and contacts the first rail, for lifting the first plate as the link member moves up the sloped part of the first rail when the container is pulled out. The accessible area of the opening of the container is enlarged as the first plate moves up when the container is pulled out.

24 Claims, 5 Drawing Sheets

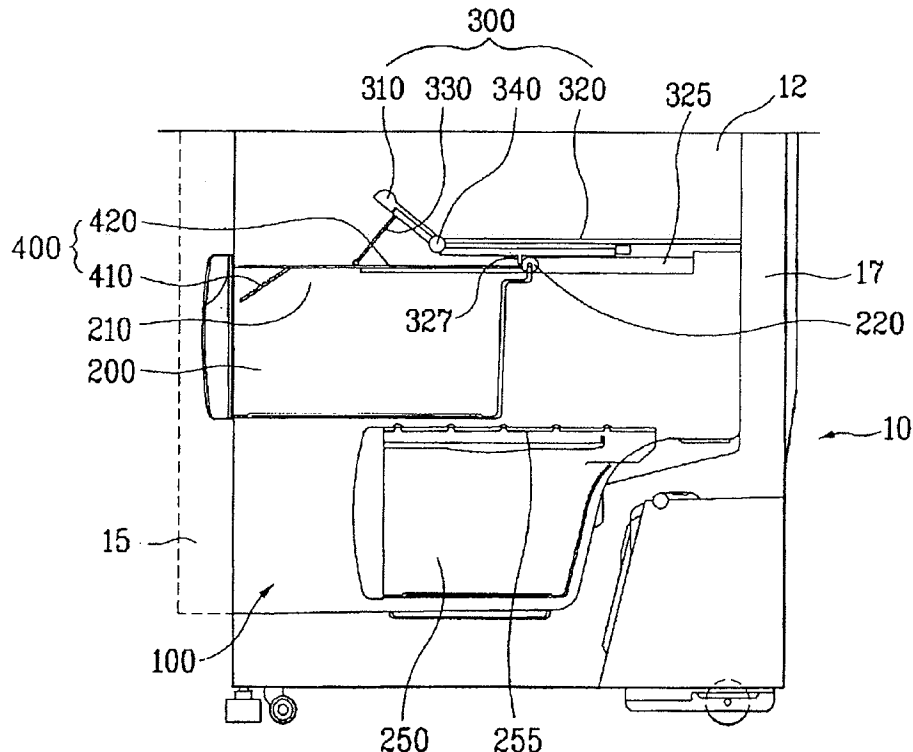
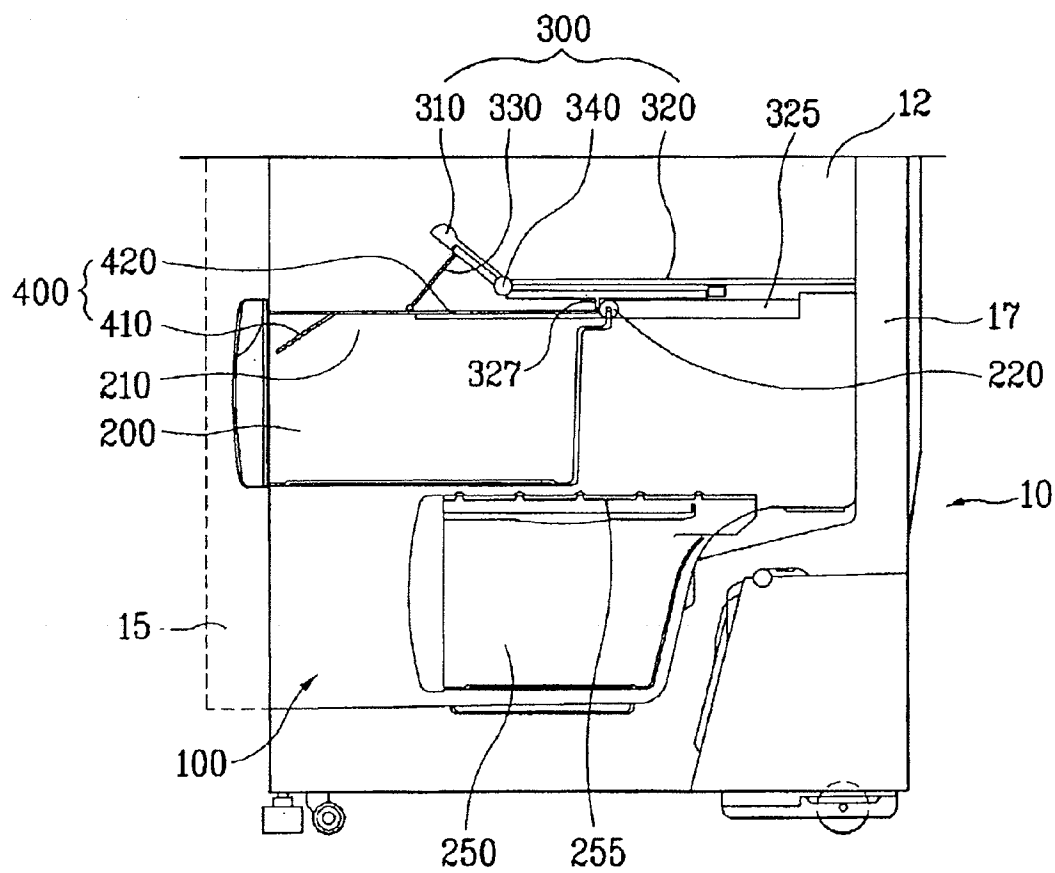


FIG.1



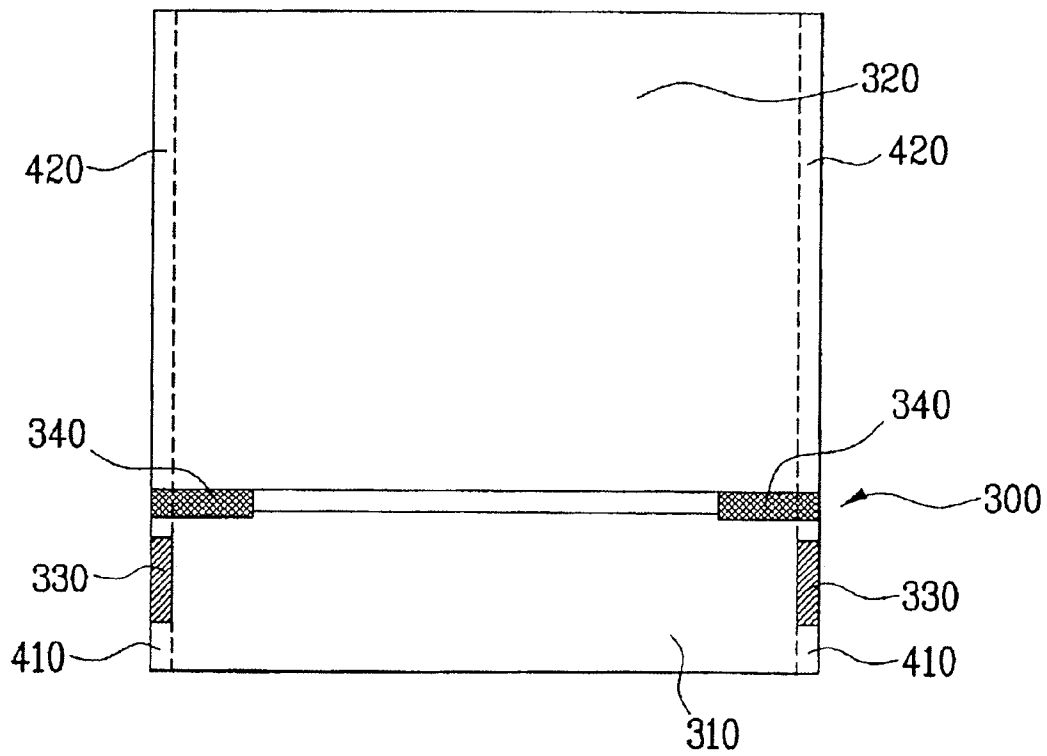
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FIG. 2



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FIG. 3A

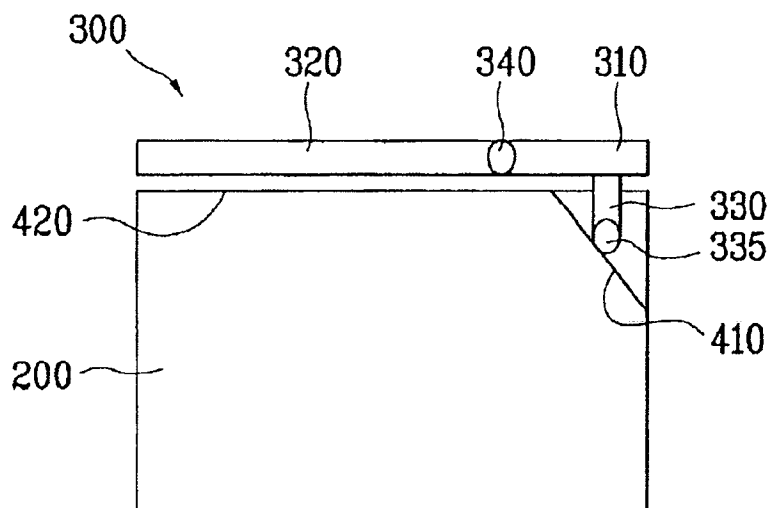
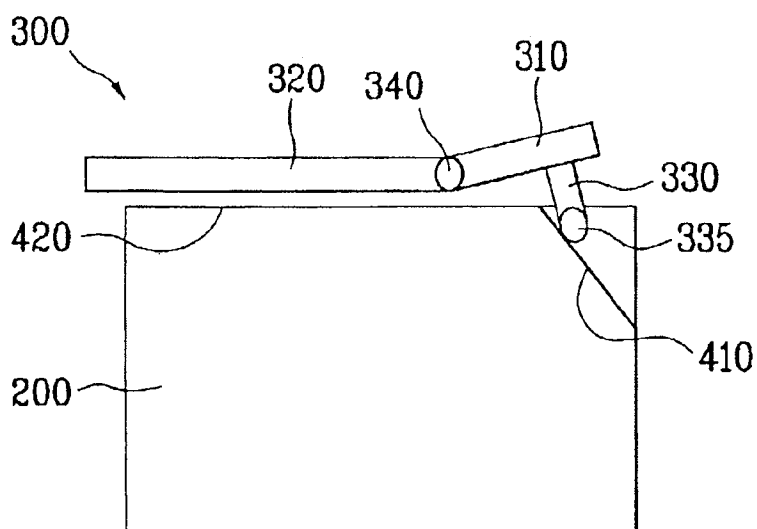


FIG. 3B



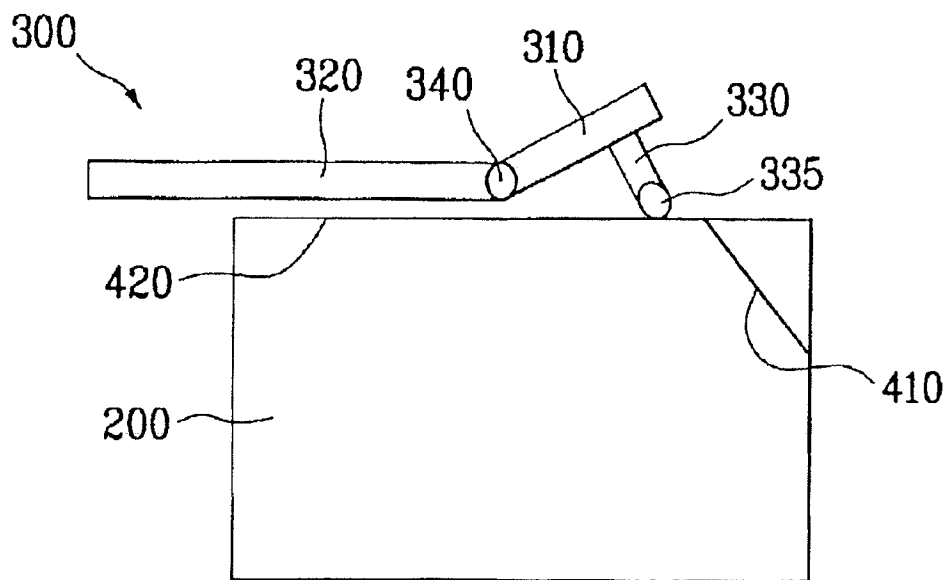
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FIG. 3C



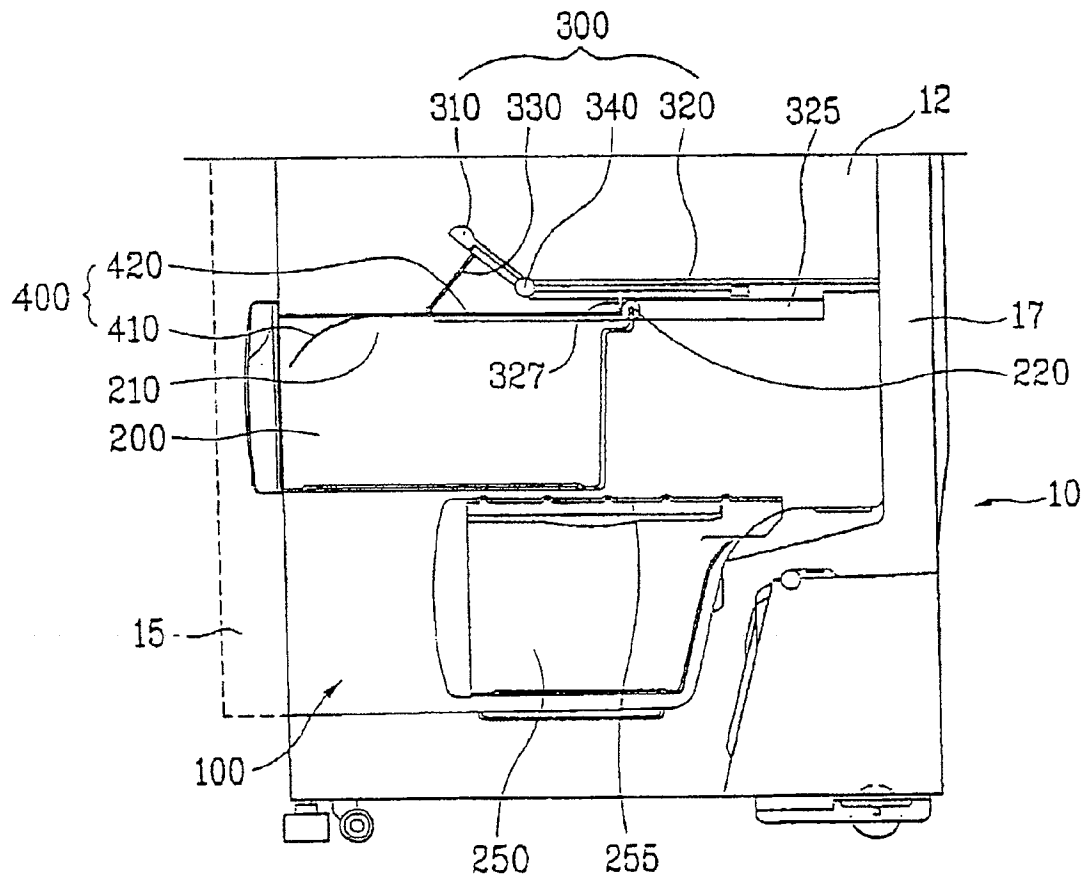
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FIG. 4



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VEGETABLE COMPARTMENT IN REFRIGERATOR

This application claims the benefit of the Korean Application No. P2002-22549 filed on Apr. 24, 2002, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a vegetable compartment in a refrigerator for fresh storage of vegetable.

2. Background of the Related Art

The refrigerator is an appliance for fresh, and long time storage of food. The refrigerator is provided with food storage chambers therein, which is always kept at a low temperature by means of a refrigerating cycle for maintaining a fresh state of the food.

The food storage chambers are provided with different characteristics so that the user selects a storage method suitable for different kinds of food taking kinds, characteristics and storage periods of the food into account. Of the food storage chambers, typical ones are the freezing chamber, the refrigerating chamber, and the vegetable compartment.

Of the storage chambers, the vegetable compartment is provided with optimal temperature and humidity for fresh storage of vegetable having a storage period shorter than processed food, always. The vegetable compartment is an independent space partitioned with a partition in the refrigerating chamber which is in general at a low temperature. A related art vegetable compartment in the refrigerator will be described.

The related art vegetable compartment in the refrigerator is a separate space partitioned from other space of the refrigerating chamber by a partition plate, also serving as a shelf, on a lower side of the refrigerating chamber. The vegetable compartment is provided with a container, top of which is opened, for putting vegetable therein. Since the container is right below the partition plate, the partition plate actually serves as a cover of the container, for covering the opened top side of the container.

For using the vegetable compartment, the user is required to open a door to the refrigerator, pull out the container, and put vegetable into the container through an inlet to the container, i.e., a part not covered with the partition plate of the opened top part of the container. However, if the container is pulled out longer than a predetermined length from the vegetable compartment, a bottom plate of the vegetable compartment can not support the contained. Therefore, for preventing the container from falling off the vegetable compartment, it is required that the pulling out length of the container is limited. However, the limitation of the pulling out length of the container substantially reduces a size of the inlet to the vegetable compartment too, which disables storage of large sized vegetable storage.

In the meantime, if it is intended to store large sized vegetable by all means, the user is required to cut the vegetable into pieces, or remove the partition plate, put the vegetable into the container and place the partition plate again.

However, the cutting of vegetable deteriorates freshness of the vegetable and can not keep proper tastes of the vegetable.

In the case of removal of the partition plate, since the partition plate also serves as a shelf, it is required to remove

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all the food stored on the partition plate, remove the partition plate, put the vegetable into the container, and return the partition plate and the food to original positions, which is very cumbersome.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a vegetable compartment in a refrigerator that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide a vegetable compartment in a refrigerator, in which an inlet structure of a container is improved for convenient putting of large sized vegetable into the container.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, the vegetable compartment in a refrigerator includes a container, a guide member, and a partition member. The container has an opening in a top side for pushing in or pulling out of the refrigerator. The guide member is fitted to the container along a direction the container is pushed in or pulled out and has a sloped part adjacent to a door of the refrigerator, which is sloped such that the sloped part becomes the higher as it goes in a direction the container is pushed in. The partition member in the refrigerator for covering a top of the container has a first plate adjacent to the door for enlarging an opened area of the opening as the first plate moves up guided by the sloped part when the container is pulled out.

The guide member includes, for an example, at least one first rail fitted to a side surface of the container. The guide member includes, for an example, the sloped part, and a horizontal part extended from an end at a high side of the sloped part to a direction the container is pushed in.

The sloped part includes a moderate straight slope rising along a direction the container is pushed in, or a moderate curved slope rising along a direction the container is pushed in. The first rail is fitted to each of opposite side surfaces of the container.

The partition member includes, for an example, a second plate, a first plate, and a link member. The second plate provided to be pushed in or pulled out of the refrigerator, for covering a part of the opening of the container. The first plate connected to the second plate, such that the first plate can make relative motion with respect to the second plate, for enlarging the opened area of the opening when the container is pulled out. The link member extended a predetermined length from the first plate such that a part thereof is in contact with the first rail, for moving up or down the first plate when the container is pushed in or pulled out, respectively. The first plate and the second plate are coupled with a hinge, or connected with a connection member of a flexible material.

The partition member further includes, for an example, a second rail fitted to an underside of the first plate for making smooth sliding in a state a part of the container is in contact therewith when the container is pushed in or pulled out. In this instance, the container further includes, for an example, a second roller for making a contain movement smooth as the second roller is in contact with the second rail and slides thereon.

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The partition member further includes, for an example, a stopper at an end of the second rail for preventing the second roller from falling off the second rail and limiting a maximum pulling out range of the container when the container is pulled out to the maximum.

The link member is, for an example, in contact with the guide member, and includes, for an example, a first roller for reducing friction between the guide member and the link member as the first roller rotates when the container is pushed in or pulled out.

The vegetable compartment in a refrigerator of the present invention further includes a supplementary container under the container for pushing in or pulling out of the refrigerator.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention:

In the drawings:

FIG. 1 illustrates a section showing one preferred embodiment of the present invention, schematically;

FIG. 2 illustrates a plan view of a vegetable compartment in FIG. 1, schematically;

FIGS. 3A-3C illustrate the steps of a process for pulling out the container from the vegetable compartment in FIG. 1, schematically; and

FIG. 4 illustrates a section showing an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. In describing the embodiments, same parts will be given same names and reference symbols, and repetitive description of which will be omitted.

Referring to FIG. 1, the vegetable compartment of the present invention is a separate space partitioned from a refrigerating chamber 12 with a partition member 300 provided to the refrigerating chamber 12 in a refrigerator 10. The vegetable compartment 100 includes a container 200, a guide member, and the partition member 300.

An embodiment will be described in detail, in which the vegetable compartment is provided under the refrigerating chamber 12, with reference to FIG. 1. However, a position of the vegetable compartment 100 is not limited to under the refrigerating chamber 12, but may be a separate space partitioned with the partition member 300 and the container 200 in a middle part of the refrigerating chamber 12, if necessary. A detailed structure of the vegetable compartment is as follows.

Referring to FIG. 1, the container 200 is provided to be pushed in and pulled out of the refrigerator 10. The container has an opening 210 in a top side for putting/taking out vegetable.

In the meantime, the refrigerator designed to have a small capacity of the vegetable compartment 100 is provided with,

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for an example, one container 200, and the refrigerator designed to have a large capacity of the vegetable compartment 100 is provided with, for an example, a supplementary container 250 additionally as shown in FIG. 1. Of course, the supplementary container 250 has an opening in a top side, and, for maintaining freshness of the vegetable stored in the supplementary container 250, there is a cover 255 provided to the opening of the supplementary container 250 additionally for covering the opening of the supplementary container 250. A number of the supplementary containers provided thus are not limited.

The container 200 or the supplementary container 250 may be one piece or two or more pieces.

FIG. 1 illustrates an embodiment in which a guide member is a rail. However, the guide member is not limited to the rail, and the rail provided as the guide member is called as a first rail for convenience of description.

The first rail 400 provided as the guide member is provided to side surfaces of the container 200, for an example, inside or outside surfaces of the side surfaces of the container 200 along a direction the container 200 is pushed in or pulled out. One first rail may be provided to one of the side surfaces of the container 200, or one pair of the first rails may be provided to the side surfaces of the container 200.

The first rail provided thus includes a sloped part 410 and a horizontal part 420. As shown in FIG. 1, the sloped part 410 is provided to a part adjacent to the door 15 of the refrigerator 10 in the side surfaces of the container 200. The sloped part 410 is provided such that a horizontal height thereof becomes the higher as it goes the farther in a direction the container 200 is pushed in, in a direction of a rear wall 17 of the refrigerator 10 in a case of the embodiment shown in FIG. 1.

Referring to FIG. 1, the sloped part 410 of the first rail 400 provided thus has a moderate straight slope rising in a direction the container 200 is pushed in. However, the sloped part 410 is not limited to this, but may have a moderate curved sloped part 410 in the direction the container 200 is pushed in, for example, as shown in FIG. 4.

Referring to FIG. 1, the horizontal part 420 of the first rail 400 is extended a predetermined distance from one end of the sloped part 410, in more detail, from one of ends of the sloped part 410 at a side a horizontal height is higher toward the direction the container 200 is pushed in.

Referring to FIG. 1, the partition member 300, provided to be pushed in/pulled out of the refrigerating chamber 12, partitions the vegetable compartment 100 from the refrigerating chamber 12. For supporting the partition member 300 in a state the partition member 300 is inserted in the refrigerating chamber 12, ledges (not shown) are projected from both sides of inside walls of the refrigerating chamber 12 in the refrigerator 10 along the direction the partition member 300 is inserted. Therefore, the partition member 300 is supported in a state both edges of the partition members 300 are placed on the ledges.

The partition member 300 serves, not only as a partition for separating the refrigerating chamber 12 from the vegetable compartment, but also as a shelf. That is, in a case of the embodiment shown in FIG. 1, since an upper space of the partition member 300 is the refrigerating chamber 12, if food is placed on the partition member 300, the partition member 300 serves as a shelf of the refrigerating chamber 12.

Moreover, since the partition member 300 is on top of the container 200, the partition member 300 covers the opening 210 of the container 200, serving to form an inside space of the container 200 as an independent space.

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The partition member 300 with the foregoing services includes a first plate 310, a second plate 320, and a link member 330, of which details are as follows.

Referring to FIG. 1, the second plate 320, provided to be pushed in or pulled out of the refrigerating chamber 12, covers a part of the opening 210 of the container 200, i.e., a region adjacent to the rear wall 17 of the refrigerator 10. Since the second plate 320 serves as a shelf in a state inserted into the refrigerating chamber 12 fully, the second plate 320 has a flat top surface. It is preferable that the second plate 320 is fitted such that the second plate 320 does not move together with the container 200 when the container 200 is pulled out or pushed in.

The first plate 310 is connected to an end of the second plate 320 adjacent to the door 15 to the refrigerator 10, such that the first plate 310 can make relative motion with respect to the second plate 320. The first plate 310 and the second plate 320 are connected with a hinge 340 or a connecting member (not shown) of a flexible plastic. The connecting member includes a first end connected to the first plate 310 and a second end connected to the second plate 320.

Referring to FIG. 2, one pair of the hinges 340 or the connection members (not shown) may be provided for connecting both sides of a width direction of the first plate 310 or the second plate 320. However, the connection method is not limited to this, but one the hinge 340 or the connection member can be provided to connect a middle part of the width direction of the first plate and the second plate 320. Moreover, a plurality of the hinges 340 or the connection members may be provided at regular or irregular intervals along a width direction of the first plate 310 and the second plate 320.

Once the first plate 310 and the second plate 320 are connected with the hinge or the flexible connection member, the first plate 310 becomes rotatable with respect to the second plate 320 around the hinge or the connection member. As shown in FIG. 1, once the first plate 310 has the foregoing structure, the first plate 310 can enlarge an opened area of the opening 210 as an end of the first plate 310 adjacent to the door 15 moves up guided by the sloped part 410 when the container 200 is pulled out, and the first plate 310 can cover an opened area of the opening 210 fully as the end of the first plate 310 adjacent to the door 15 moves down guided by the sloped part 410 when the container 200 is pushed in.

In the meantime, when the container 200 is pushed in, or pulled out, the first plate 310 moves down or up as the first plate 310 rotates around the hinge. Therefore, no food is placed on the first plate 310, and, consequently, different from the second plate 320, the first plate 310 does not serve as a shelf.

Referring to FIG. 1, the link member 330 is extended from the first plate 310 for a predetermined length, for an example, such that an end thereof is in contact with the guide member, in the case of the first embodiment, the first rail 400. When one first rail 400 is provided, one link member 330 is extended from the first plate 310 so as to contact with the first rail 400. As shown in FIG. 2, when one pair of the first rails 400 are provided, one pair of the link members 330 are extended from the first plate 310 and in contact with the first rails 400, respectively.

A part where the link member 330 and the first plate 310 are joined are rigid unable to make a relative motion. The link member 330 and the first plate 310 may be attached after the link member 330 and the first plate 310 are fabricated as individual pieces, or may be formed as one unit.

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If the link member 330 is extended from the first plate as above, the link member 330 and the first plate 310 are always movable altogether. That is, since the link member 330 is always in contact with the first rail 400 as above, the link member 330 moves up or down guided by the sloped part 410 and the horizontal part 420 of the first rail 400 when the container 200 is pushed in, or pulled out, according to which the first plate 310 rigidly joined with the link member 330 moves up or down as the first plate 310 rotates around the hinge 340. According to this, as shown in FIG. 1, when the container 200 is pulled toward the door side, the first plate 310 is lifted as the first plate 310 rotate upward, to enlarge an opening of the container 200, i.e., an opened area of the opening 210 actually. When the container 200 is pushed toward the rear wall 17 of the refrigerator 10, the link member 330 is moved down guided by the sloped part 410, and the first plate 310 is restored to an original position.

Meanwhile, the link member 330 may be provided with a roller for reducing friction with the guide member and making smooth relative motion between two members. For convenience of description, the roller provided to the link member 330 is called as a first roller 335.

The first roller 335 is provided to a contact part with the guide member, for an example, a contact part with the first rail 400 in the case of the embodiment shown in FIG. 1. In the case of FIG. 1, the first roller 335 is provided to an end of the link member 330. The first roller 335 provided thus keeps contact with the guide member, the first rail 400 in the case of the embodiment in FIG. 1, and rotates when the container is pulled out or pushed in, to reduce friction between the first rail 400 and the link member 330.

In the meantime, the vegetable compartment of the present invention is provided with a structure for making the pushing in and pulling out of the container 200 smooth. To do this, the partition member 300 includes a rail, and the container 200 includes a roller, further. For convenience of description, the rail provided to the partition member 300 is called as a second rail 325, and a rail provided to the container 200 is called as a second roller 220.

Referring to FIG. 1, the second rail 325 is fitted to an underside of the partition member 300, in more detail, underside of the second plate 320. The second rail 325 is fitted in the direction the container 200 is pushed in or pulled out, for guiding relative motion of the partition member 300 and the second plate 320 by designing a part of the container 200, for an example, the second roller 220, to slide smoothly in a state the second roller 220 is in contact with the second rail 325 when the container 200 is pushed in or pulled out.

The second roller 220 is provided to one side of the container 200, for an example, to a top side of the container 200 as shown in FIG. 1. The roller 220 is provided to, for an example, the top side of an end of the container 200 adjacent to the rear wall 17 of the refrigerator 10, for smooth guidance of the relative motion of the container 200 and the partition member 300 as the second roller 220 is in contact with, and slides on the second rail 325.

The vegetable compartment 100, having the structure for making smooth relative motion of the partition member 300 and the container 200 by means of the roller and the rail, further includes means for limiting a pulling out range of the container 200 while preventing falling off of the container 200. For this, the partition member 300 further includes a stopper 327.

Referring to FIG. 1, the stopper 327 is provided to an end of the second rail 325 adjacent to the door 15, for limiting a maximum pulling out range of the container 200 while

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preventing the second roller 220 from falling off the second rail 325 when the container 200 pulled out to the maximum.

The principle of enlargement/reduction of the opened area of the inlet to the container 200, i.e., the opening 210 in using the vegetable compartment 100 will be described with reference to FIGS. 3A-3B.

FIG. 3A illustrates a configuration of the partition member 300 and the container 200 when the container 200 is pushed in the vegetable compartment fully. In the case of FIG. 3A, the second plate 320 covers an area of the opening 210 in the container 200 in a state the second plate 320 is supported on the ledges on the inside wall of the refrigerating chamber 12. The first roller 335 of the link member 330 is in contact with a lower part of the sloped part 410, when the first plate 310 and the second plate 320 connected with the hinge 340 are leveled when seen from a side.

Under this state, if pulling out of the container 200 is started after the door 15 of the refrigerator 10 is opened, as shown in FIG. 3B, the link member 330 moves up guided by the sloped part 410, and, according to this, the first plate 310 rotates upward around the hinge 340. When the first plate 310 rotates upward around the hinge 340, the end of the first plate 310 adjacent to the door 15 is lifted, to enlarge the opened area of the inlet to the container 200, i.e., the opening 210, actually.

Then, as shown in FIG. 3C, when the container 200 is pulled out further, the link member 330 comes from the sloped part 410 to the horizontal part 420. After the link member 330 comes to the horizontal part 420 thus, only the container 200 is pulled out in a state the first plate 310 is left stationary.

When the container 200 is pulled out thus, since the first plate 310 moves up with a slope, to enlarge the opened area of the inlet of the container 200, i.e., the opening 210, even large sized vegetable can be put into the container 200 through the inlet of the container 200.

After the vegetable is stored in the container 200, the container 200 is pushed in toward the rear wall 17 of the refrigerator 10. When the container 200 is pushed in, the link member 330 is guided by the horizontal part 420 of the first rail 400, when the first plate 310 does not rotate. As the container 200 is pushed in further, the link member 330 comes from the horizontal part 420 to the sloped part 410, when the first plate 310 rotates to move downward. As shown in FIG. 3A, once the container 200 is pushed in fully, the first plate 310 is on the same plane with the second plate 320, and the opening 210 of the container 200 is covered by the first plate 310 and the second plate 320, fully.

The vegetable compartment 100 of the present invention enlarges the opened area of the opening 210 of the container 200 as the first plate 310 rotates upward around the hinge 340 when the container 200 is pulled out. The second plate 320 serves both as a shelf of the refrigerating chamber 12 and the cover on the opening 210 of the container 200.

In the present invention, a size of an area serving as the shelf for placing food thereon, and a size of the enlargeable opened area of the container 200 are fixed by adjusting sizes of the second plate 320 and the first plate 310 when a size of the partition member 300 is the same.

In the meantime, when the size of the first plate 310 is the same, the enlargeable opened area of the container 200 is fixed depending on an upward maximum rotation angle of the first plate 310. In this instance, the length of the link member 330 extended from the first plate 310, and an angle between the link member 330 and the first plate 310, a joint point of the link member 330 and the first plate 310, and a

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position and a sloped angle of the sloped part 410 are taken into account in the design.

Since the vegetable compartment in a refrigerator of the present invention enlarges the opened area of the container as a part of the partition member rotates upward in pulling out the container, the vegetable can be put into the container conveniently, even large sized vegetable can be put in.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention.

For an example, the guide means for guiding the link member is not limited to the rail.

As one example, if a system is designed such that a rail like long projection is formed on an inside or outside surface of the container, and the link member is made to contact with a top of the projection, the system will serve as the guide means, adequately.

As another example, if a system is designed such that a long groove is formed in the inside or outside surface of the container, and a part of the link member, such as the first roller is placed thereon, so that the link member moves with respect to the container in a state the first roller is placed in the groove, the system will serve as the guide means, adequately.

Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A compartment for use in a refrigerator comprising:
 - a container having an opening in a top side, for alternately pushing in and pulling out of the refrigerator;
 - a guide member fitted to the container along a direction the container is pushed in or pulled out having a sloped part proximate to a door of the refrigerator, the sloped part sloped such that the sloped part becomes higher in a direction the container is pushed in; and
 - a partition member for at least partially covering the opening, having a first plate proximate to the door for enlarging an accessible area of the opening, wherein the first plate moves up guided by the sloped part when the container is pulled out.
2. The compartment as claimed in claim 1, wherein the guide member includes at least one first rail fitted to a side surface of the container, wherein the first rail includes:
 - the sloped part, and
 - a horizontal part extended from an end at a high side of the sloped part to a direction the container is pushed in.
3. The compartment as claimed in claim 2, wherein the first rail is fitted to each of opposite side surfaces of the container.
4. The compartment as claimed in claim 2, wherein the sloped part includes a moderate straight slope rising along a direction the container is pushed in.
5. The compartment as claimed in claim 2, wherein the sloped part includes a moderate curved slope rising along a direction the container is pushed in.
6. The compartment as claimed in claim 2 wherein the partition member includes a link member extended a predetermined length from the first plate such that a part thereof is in contact with the first rail, for moving up or down the first plate when the container is pushed in or pulled out, respectively.
7. The compartment as claimed in claim 6, wherein the link member is in contact with the first rail, and includes a

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first roller for reducing friction between the first rail and the link member as the first roller rotates when the container is pushed in or pulled out.

8. The compartment as claimed in claim 1, wherein the partition member includes:

a second plate provided to be pushed in or pulled out of the refrigerator, for covering a part of the opening of the container,

the first plate connected to the second plate, such that the first plate can make relative motion with respect to the second plate, for enlarging the opened area of the opening when the container is pulled out, and

a link member extended a predetermined length from the first plate such that a part of the link member is in contact with the guide member, for moving the first plate downward when the container is pushed in and upward when the container is pulled out.

9. The compartment as claimed in claim 8, wherein the first plate and the second plate are coupled with a hinge.

10. The compartment as claimed in claim 8, wherein the first plate and the second plate are connected with a connection member of a flexible material, wherein the connection member includes:

a first end connected to the first plate, and

a second end connected to the second plate.

11. The compartment as claimed in claim 8, wherein the link member includes a first roller for reducing friction between the guide member and the link member as the first roller rotates when the container is pushed in or pulled out.

12. The compartment as claimed in claim 8, wherein the partition member includes a partition rail fitted to an underside of the first plate for making smooth sliding in a state a part of the container is in contact therewith when the container is pushed in or pulled out.

13. The compartment as claimed in claim 12, wherein the container further includes a second roller for making a container movement smooth as the second roller is in contact with the partition rail and slides thereon.

14. The compartment as claimed in claim 13, wherein the partition member further includes a stopper at an end of the partition rail for preventing the second roller from falling off the partition rail and limiting a maximum pulling out range of the container when the container is pulled out to the maximum.

15. The compartment as claimed in claim 1, wherein the partition member further includes a partition rail fitted to an underside of the partition member, so that the container can make a smooth sliding in a state a part of the container is in contact with the partition rail in pushing in or pulling out of the container.

16. The compartment as claimed in claim 15, wherein the container further includes a second roller for making a container motion smooth as the second roller is in contact with the partition rail and slides thereon.

17. The compartment as claimed in claim 16, wherein the partition member further includes a stopper at an end of the partition rail for preventing the second roller from falling off the partition rail and limiting a maximum pulling out range of the container when the container is pulled out to the maximum.

18. The compartment as claimed in claim 1, further comprising a supplementary container under the container for pushing in or pulling out of the refrigerator.

19. A compartment for storing items in a refrigerator comprising:

a container having an opening in a top side, for pushing in or pulling out of the refrigerator;

at least one first rail fitted to a side surface of the container having a sloped part adjacent to a door of the

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refrigerator, the sloped part being sloped such that the sloped part becomes higher in a direction the container is pushed in, and a horizontal part extended from an end at a high side of the sloped part to a direction the container is pushed in; and

a partition member including a second plate provided to be pushed in or pulled out of the refrigerator for covering a part of the opening of the container, and a first plate fitted to a part proximate to a door of the refrigerator, the first plate connected to the second plate, such that the first plate can make relative motion with respect to the second plate, for enlarging the uncovered area of the opening as the first plate moves up guided by the sloped part when the container is pulled out, and a link member extended a predetermined length from the first plate such that a part thereof is in contact with the first rail, for lowering and raising the first plate when the container is pushed in and pulled out, respectively.

20. The compartment as claimed in claim 19, further comprising:

a second rail fitted to an underside of the partition member, so that the container can make a smooth sliding in a state a part of the container is in contact with the second rail in pushing in or pulling out of the container;

a second roller for making a container motion smooth as the second roller is in contact with the second rail; and

a stopper at an end of the second rail for preventing the second roller from falling off the second rail and limiting a maximum pulling out range of the container.

21. A storage compartment comprising:

a container having an access opening, wherein the container is configured to be displaceably disposed in a refrigerator;

a guide member formed on the container, the guide member including a first guide portion and a second guide portion, the first guide portion angled relative to the second guide portion, wherein the first guide portion is configured to be nearer than the second guide portion to a door-side of the refrigerator; and

a partition member configured to be positioned over the container, the partition member including a first plate to at least partially cover the access opening, the first plate configured to move according to the first guide portion to a propped position above the access opening by displacement of the container toward the door-side of the refrigerator.

22. The storage compartment of claim 21, wherein the partition member further comprises a second plate to at least partially cover the access opening, wherein the first plate is configured to be nearer than the second plate to a door-side of the refrigerator, and wherein the first plate and the second plate are configured to be substantially planar when the container is in a stowed position.

23. The storage compartment of claim 21, wherein the partition member further comprises at least one rail formed on an underside of the partition member, wherein the at least one rail rides along the guide member, and wherein the at least one rail causes the partition member to assume the propped position as the container is displaced toward the door-side of the refrigerator.

24. The storage compartment of claim 21, further comprising a propping device having a first plate engagement portion and a guide member engagement portion, the guide member portion including a rotatable device that rides along the guide member.

* * * * *

EXHIBIT 9



US007147292B2

(12) **United States Patent**
Lee et al.

(10) **Patent No.:** US 7,147,292 B2
 (45) **Date of Patent:** Dec. 12, 2006

(54) **OBTURATOR FOR REFRIGERATOR**

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 Ho Lee, Busan-si (KR)

(73) **Assignee:** LG Electronics Inc., Seoul (KR)

(*) **Notice:** Subject to any disclaimer, the term of this
 patent is extended or adjusted under 35
 U.S.C. 154(b) by 0 days.

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Jun. 4, 2002	(KR)	2002-31356

(51) **Int. Cl.**

E06B 7/16 (2006.01)

(52) **U.S. Cl.** 312/296; 312/405; 49/492.1

(58) **Field of Classification Search** 312/405,
 312/326, 327, 328, 329, 296; 49/489.1, 475.1,
 49/498.1, 492.1

See application file for complete search history.

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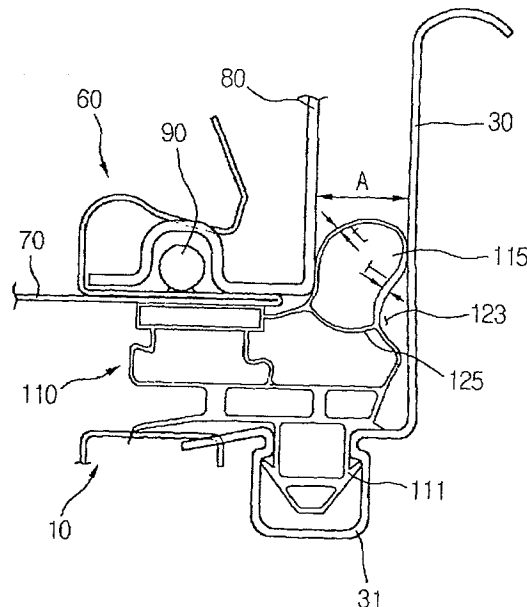
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(57) ABSTRACT

The present invention relates to an obturator for a refrigerator for cutting off heat or cool air transferred to and from a refrigerator. The present invention is comprised of a door gasket having an air bag that is transformed and rotated freely, and a projecting portion that is projected from at least one of the inner case and the refrigerator door liner, so that inflow of heat from outside or from a hot-line, into an inside of the refrigerator and leakage of the inside cool air of the refrigerator to the outside, are cut off or minimized and insulation performance is improved remarkably.

12 Claims, 12 Drawing Sheets



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Fig. 1 (Related Art)

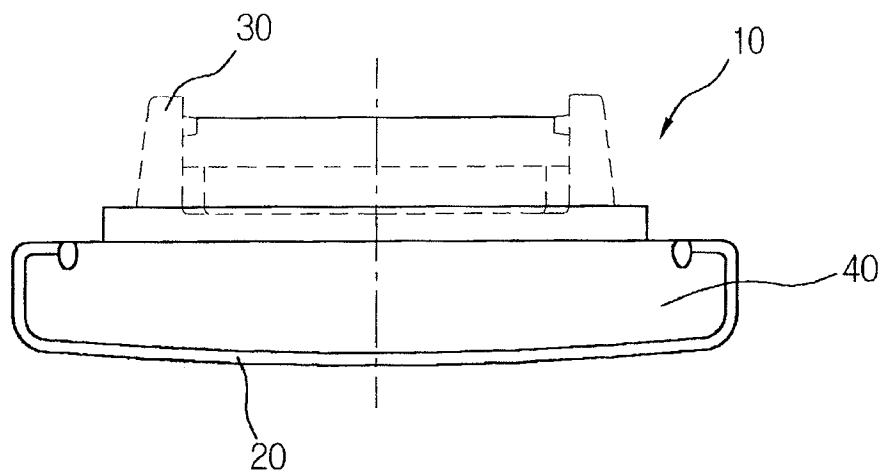


Fig. 2 (Related Art)

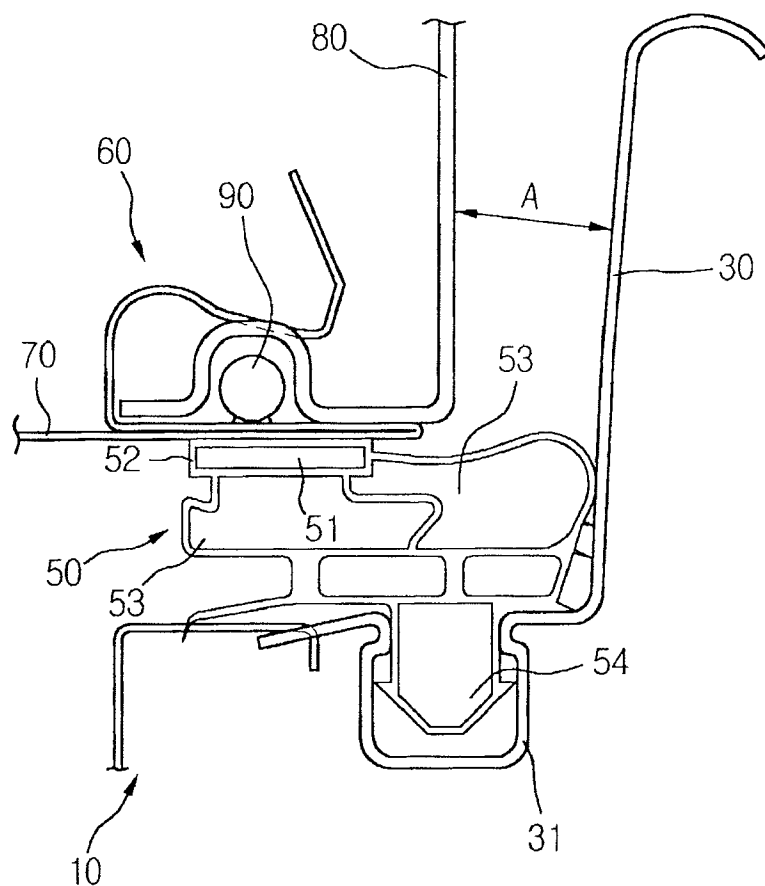


Fig. 3

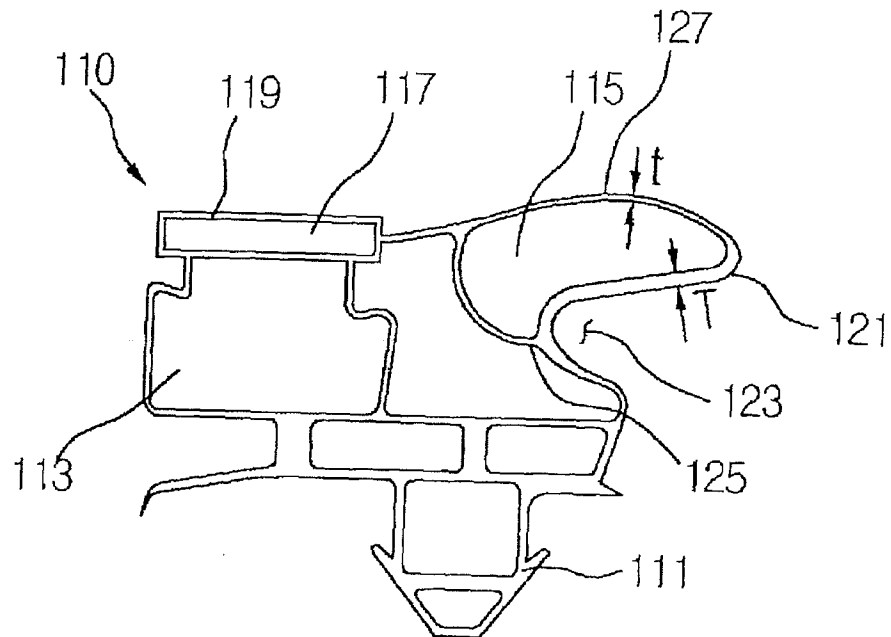
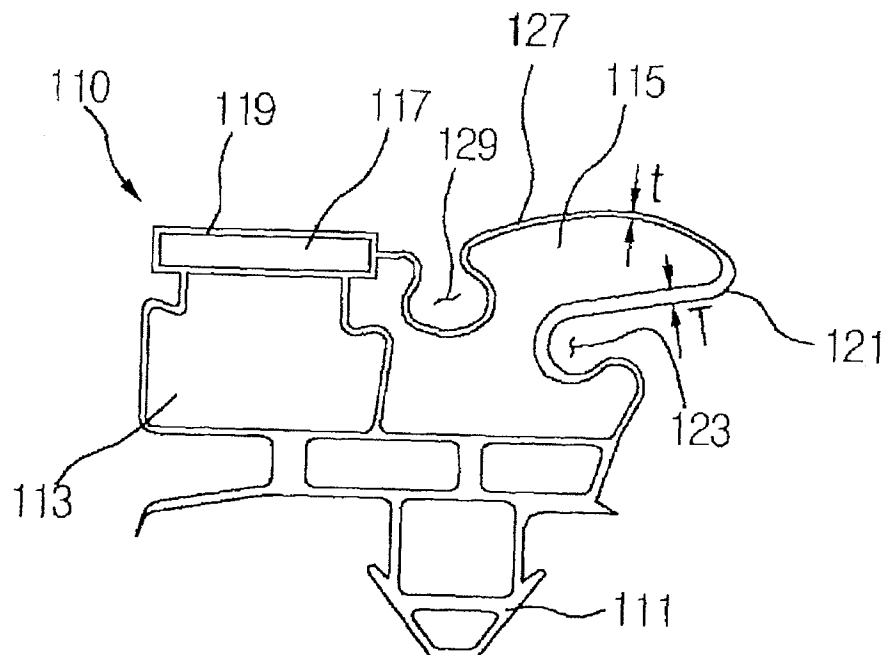


Fig. 4



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Fig. 5

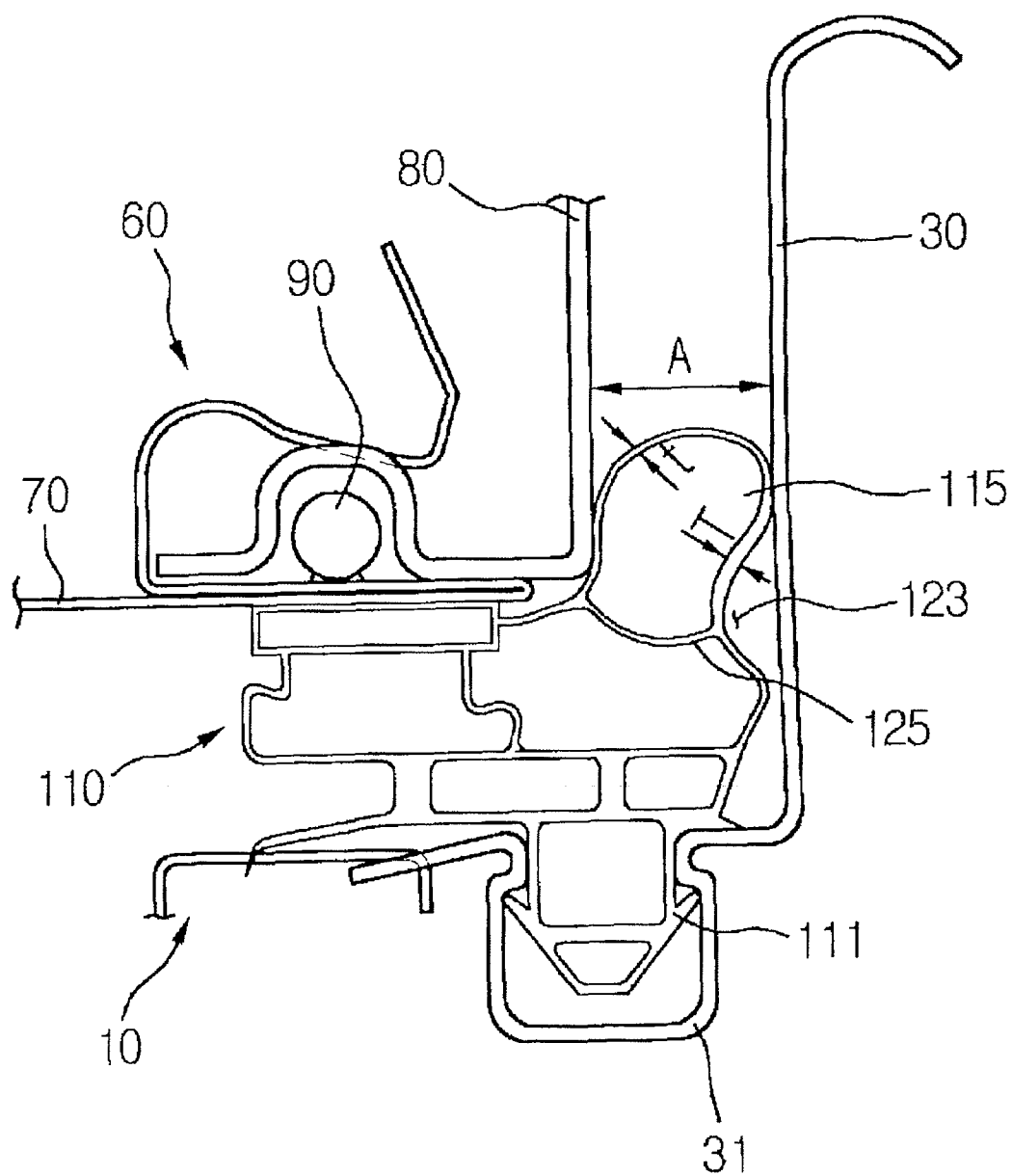
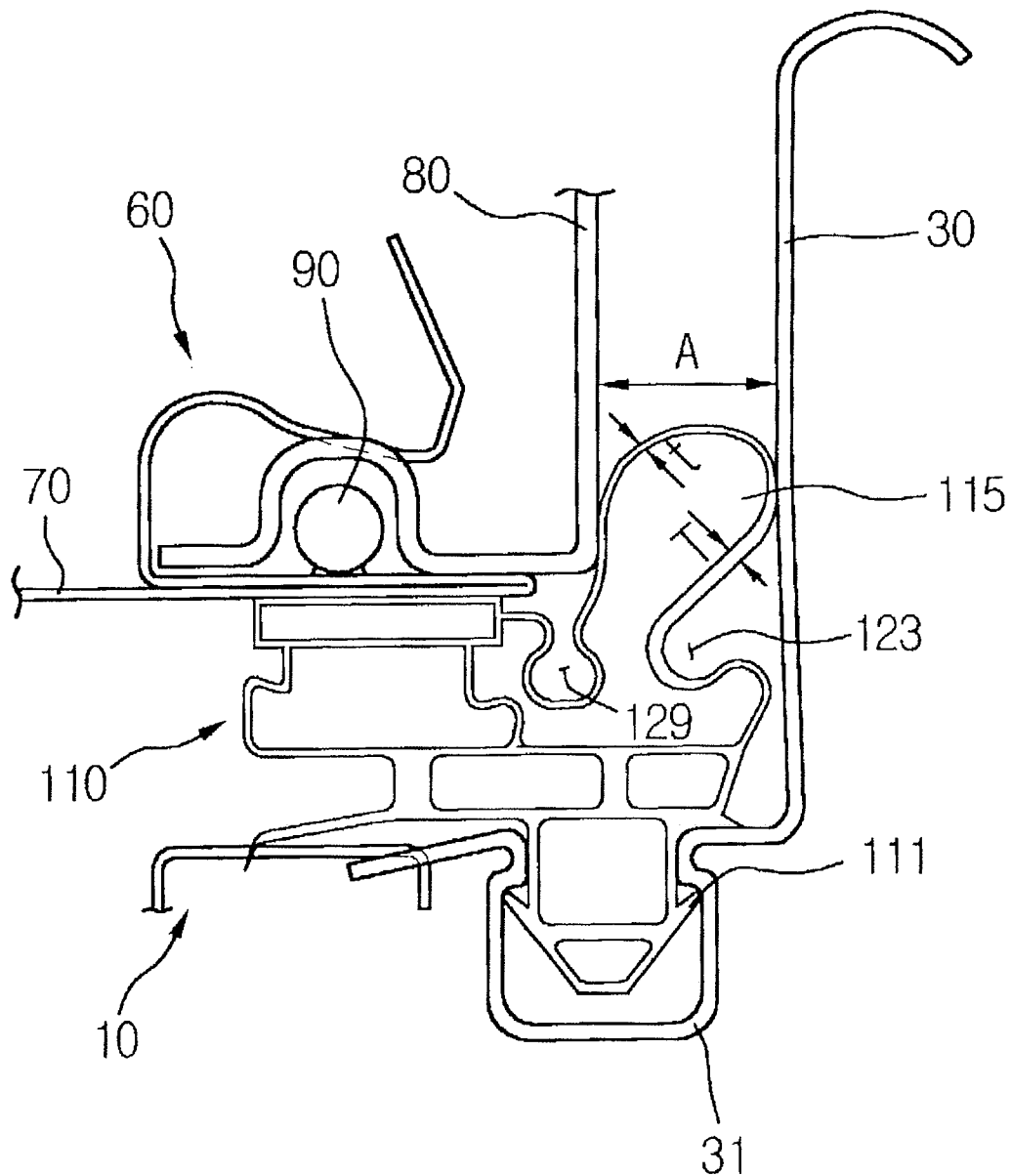


Fig. 6



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Fig. 7

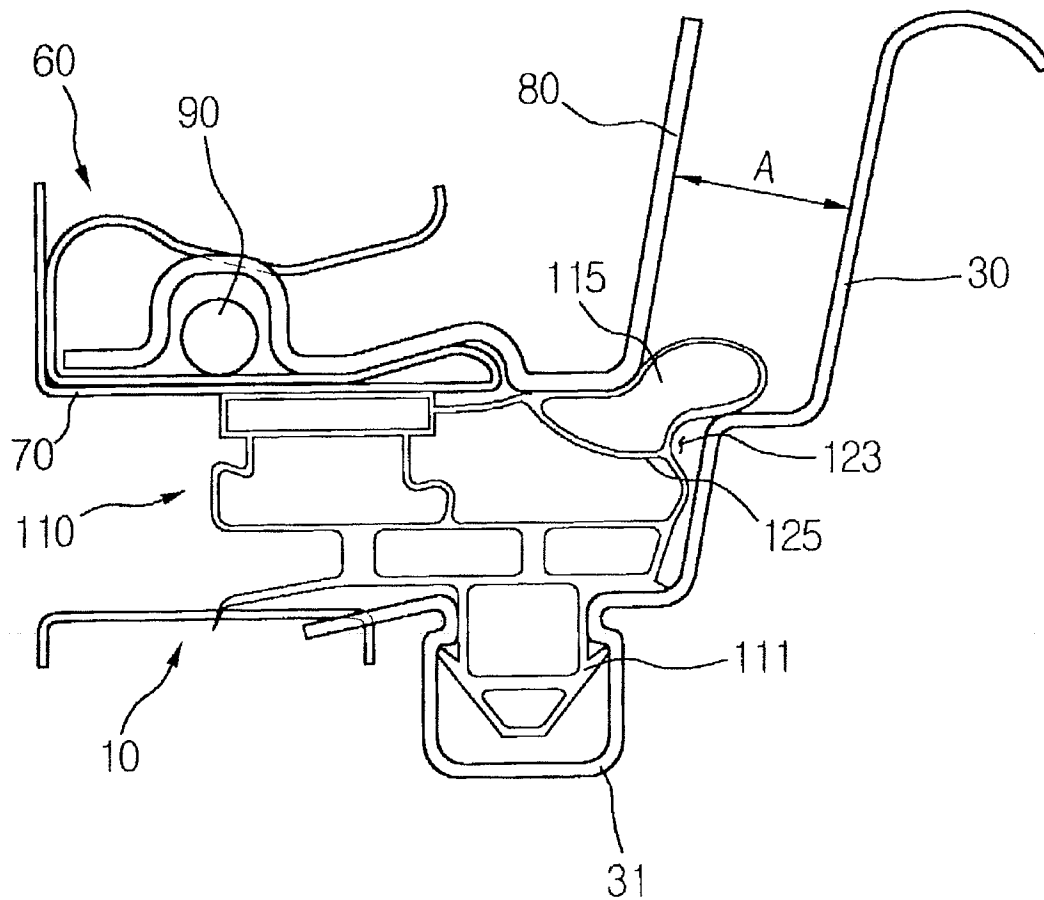
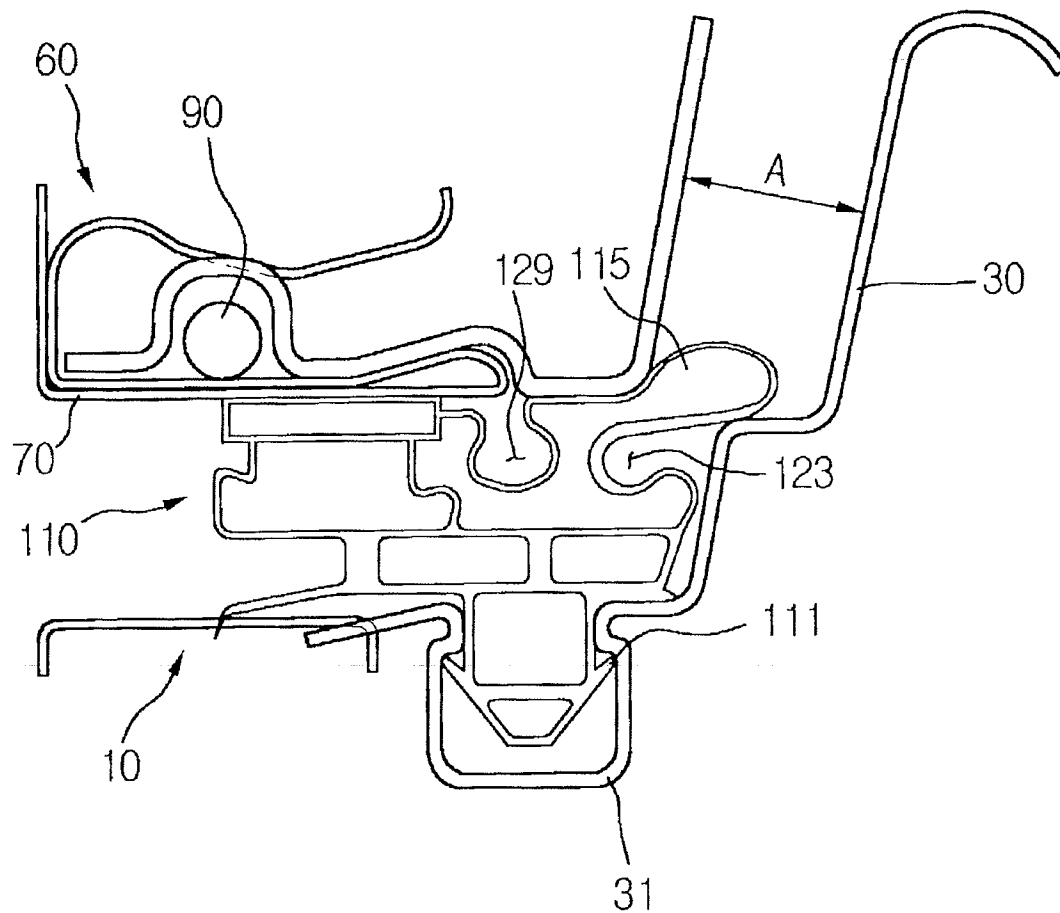


Fig. 8



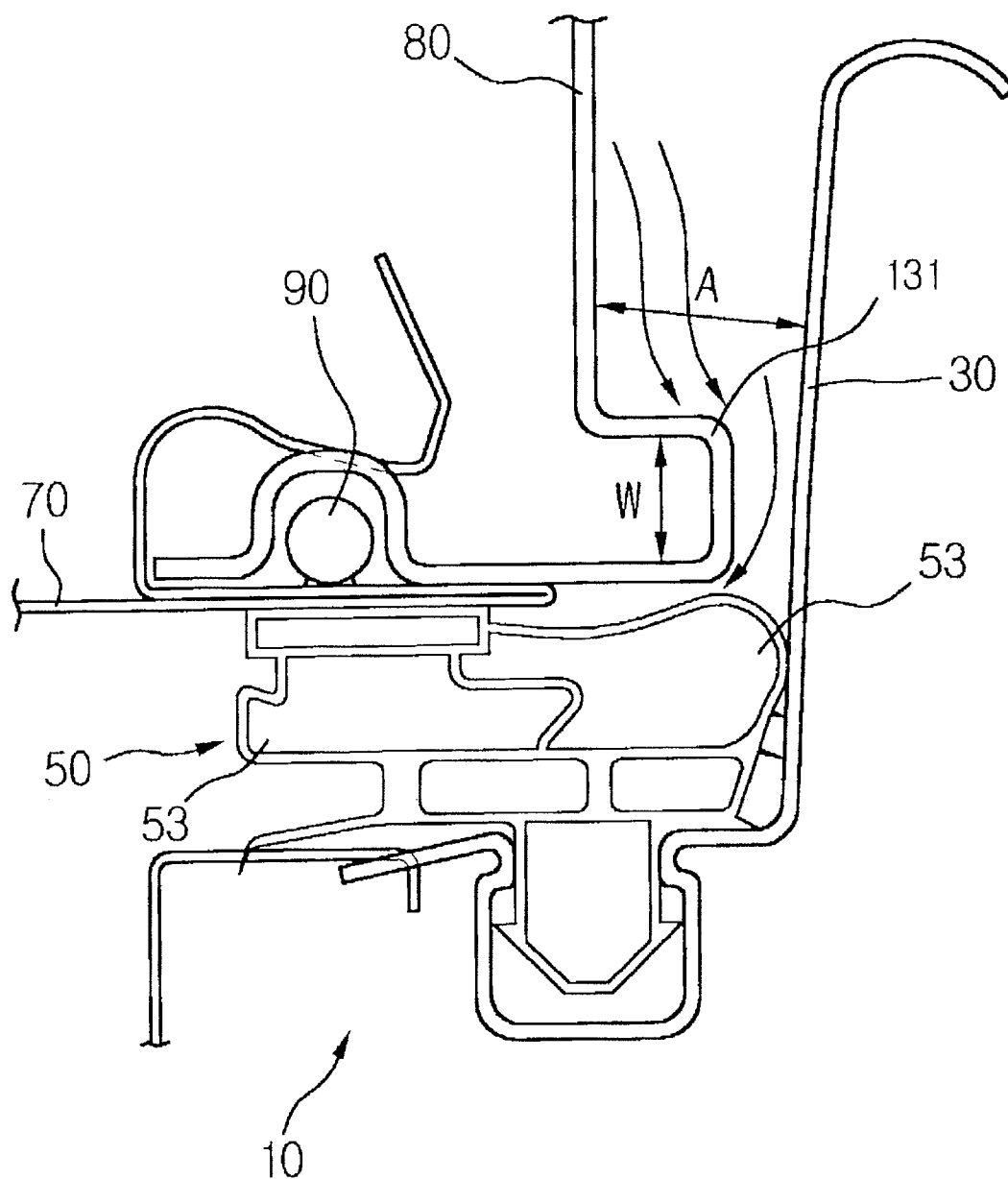
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Fig. 9



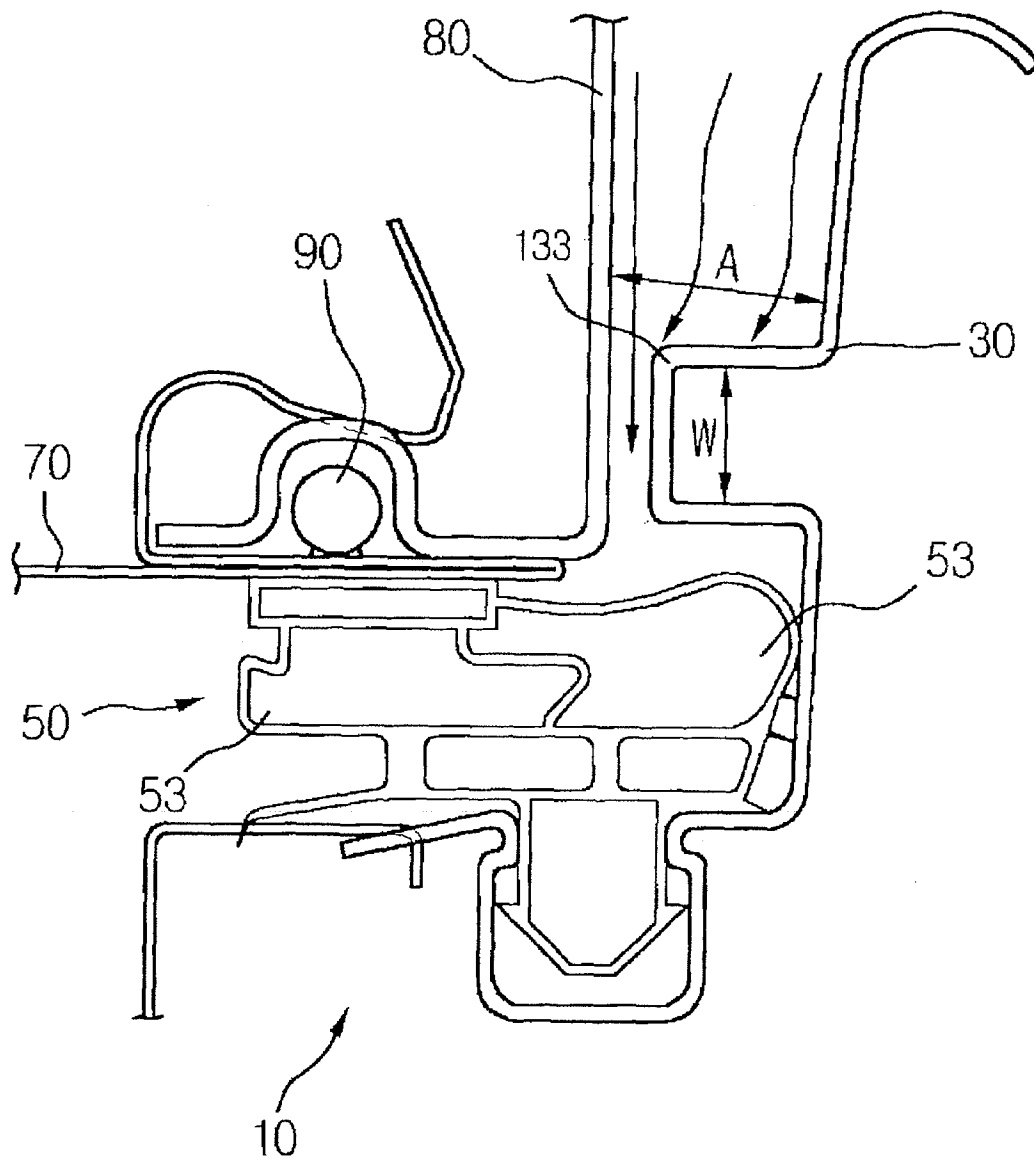
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Fig. 10



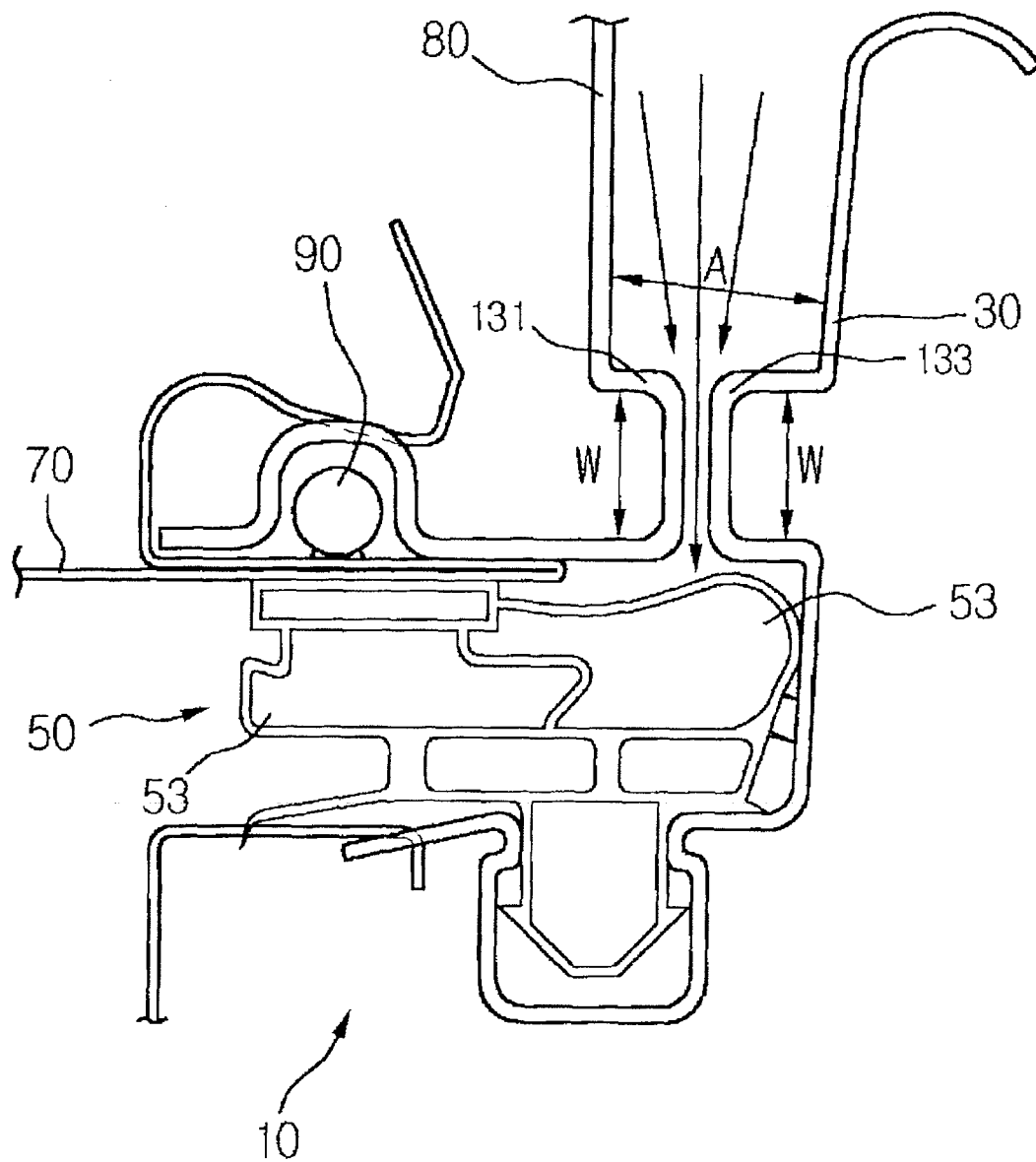
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Fig. 11



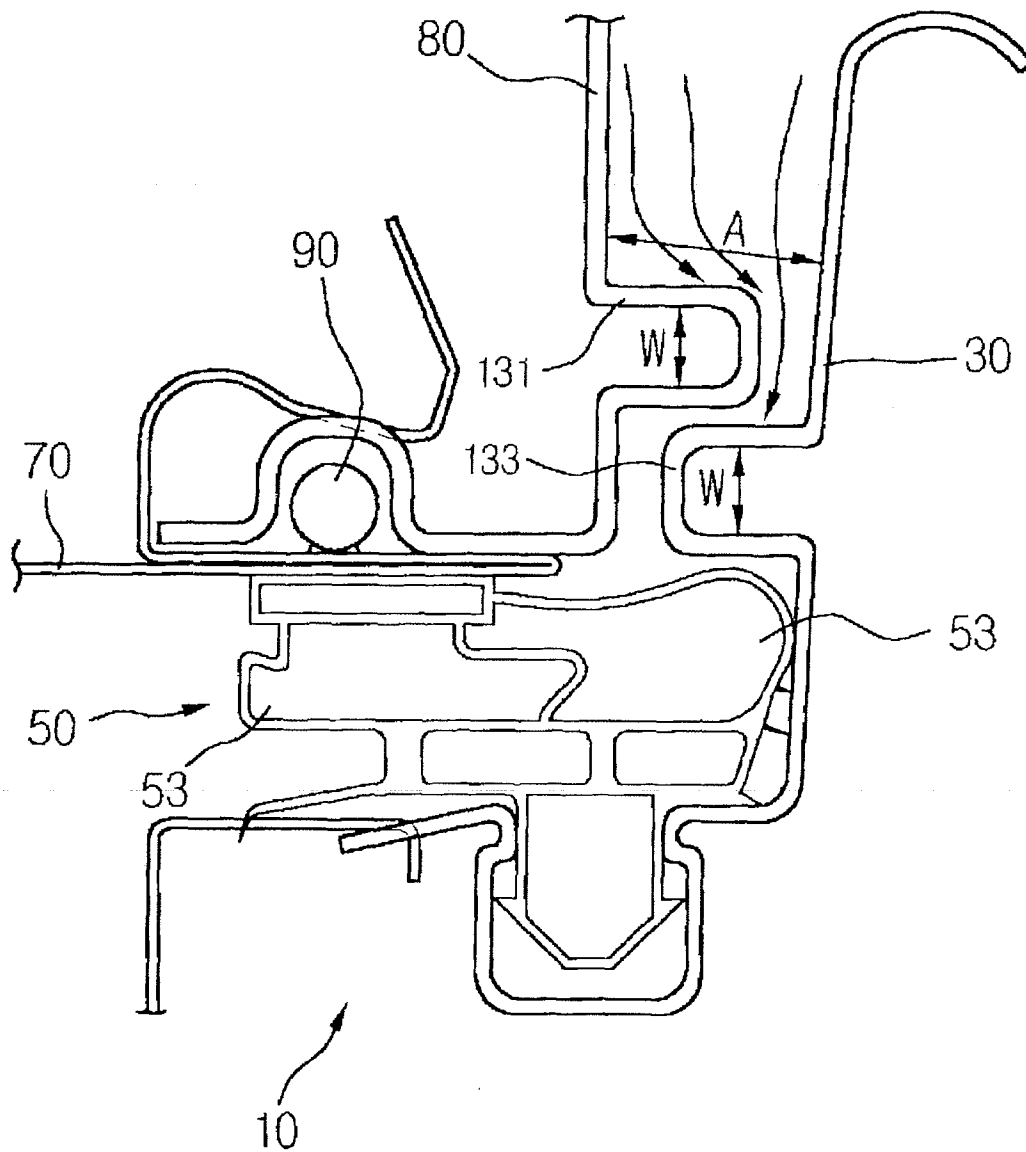
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Fig. 12



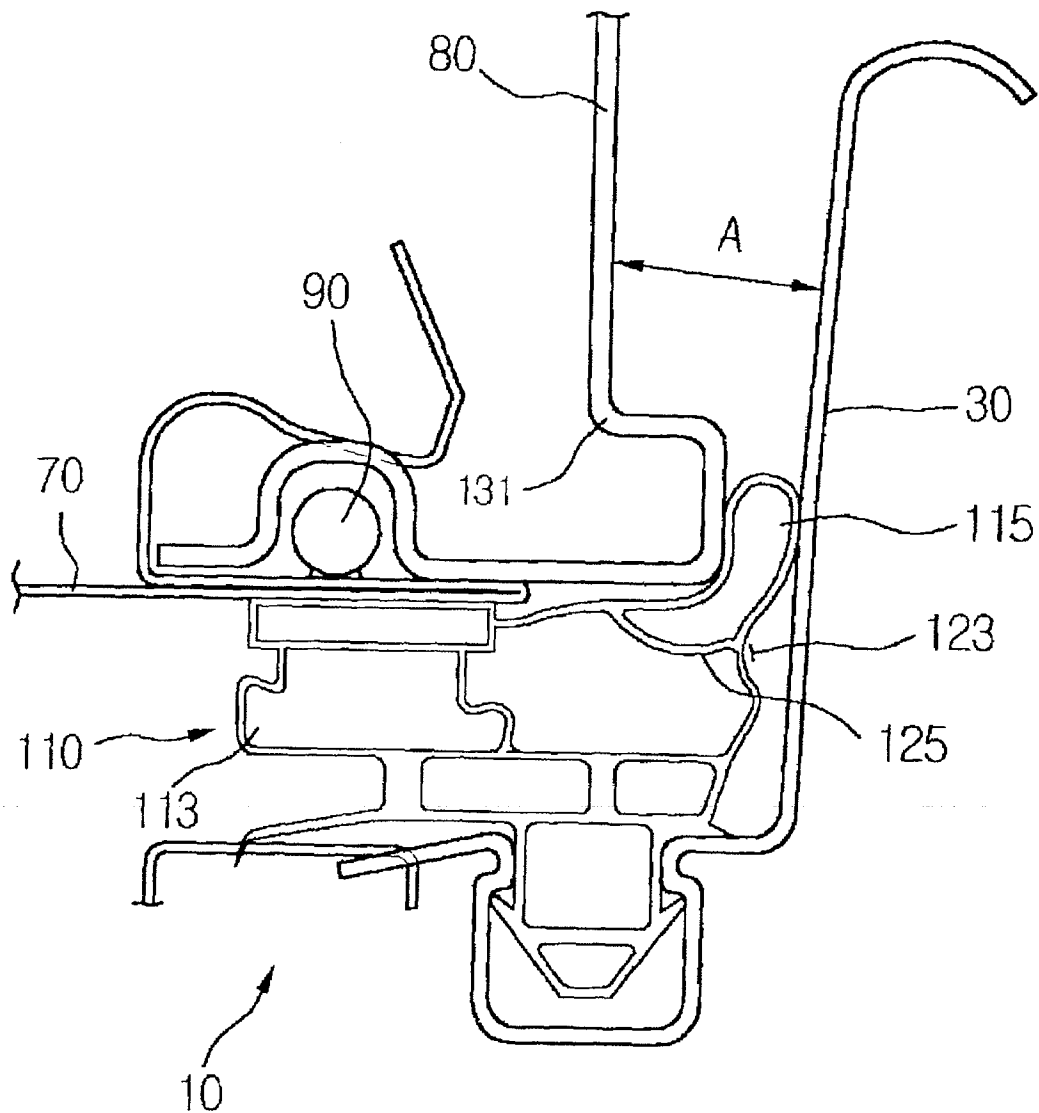
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Fig. 13



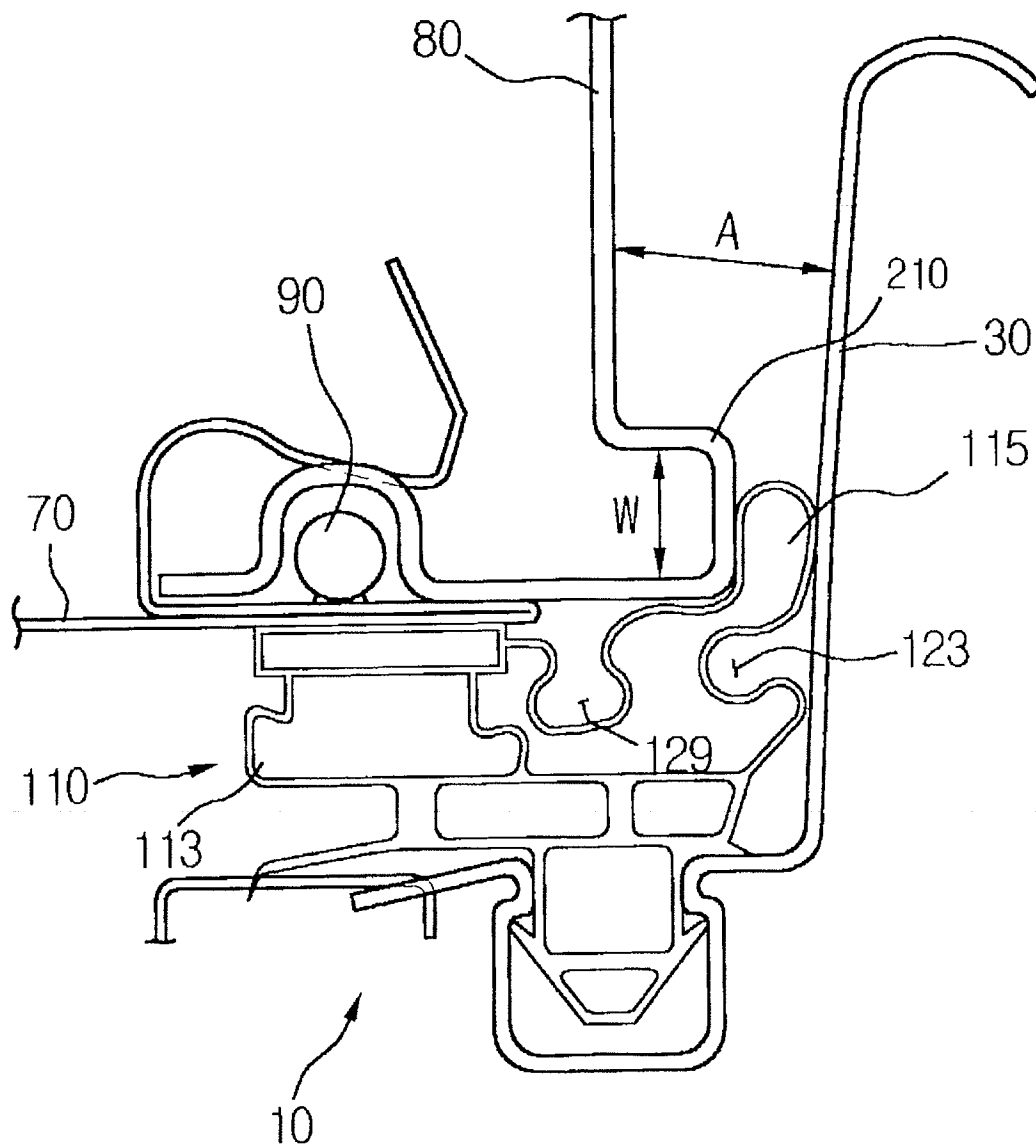
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Fig. 14



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OBTURATOR FOR REFRIGERATOR**BACKGROUND OF THE INVENTION****1. Field of the Invention**

The present invention relates to a refrigerator, and more particularly, to an obturator for a refrigerator for excluding heat or cool air that transfers to and from a refrigerator.

2. Description of the Related Art

Generally, a refrigerator discharges cool air generated by a freezing cycle comprising a compressor, a condenser, an expansion valve, an evaporator, thereby lowering temperature for freezing or chilling foods. A refrigerator is equipped with a door gasket at a door liner, i.e., an inner edge of a refrigerator door for excluding heat flow into a refrigerator from outside as well as preventing cool air discharged to a refrigerator from leaking out to the outside.

FIG. 1 is a view showing a door of a conventional refrigerator. Referring to FIG. 1, a refrigerator door 10 is comprised of an outer door 20 made of iron plate, a door liner 30 for combining with the outer door 20 using ABS resin of predetermined shape manufactured by vacuum molding process, an urethane foaming member 40 manufactured by foam molding process, mounted between the outer door 20 and the door liner 30 for insulation. Here, in one side of the door liner 30 a door gasket for isolating an interior of a refrigerator from the outside, is mounted.

FIG. 2 is a view showing the door gasket mounted on a door liner of mullion part partitioning a freezer and a cool chamber in a conventional refrigerator door. Referring to FIG. 2, the conventional door gasket 50 is comprised of a sticking part 52 for sticking on an outer case 70 of a main body in a refrigerator with the help of magnetic force generated by installed magnet 51 within it; an air bag 53 formed at the bottom of the sticking part 52 as one body together with the sticking part and divided into many regions by partitions for making, at the bottom of the sticking part, predetermined spaces to which air could be instilled so as to alleviate impulse; a combining part 54 of an anchor shape, formed at the bottom of the air bag 53 as one body together with the air bag for fixing in a combining groove 31 of the door liner 30. Here, the air bag 53 is provided for alleviating impulses generated when the refrigerator door 10 is closed on the refrigerator's main body 60. Also, the outer case 70, preferably, may be made of magnetic material so that attractive force is exerted therebetween by the magnet 51.

When the refrigerator door 10 is closed onto a front surface of the refrigerator's main body 60, attractive force is exerted between the magnet 51 installed within the sticking part 52 and the outer case 70, so that the refrigerator door 10 get stuck on the main body 60, whereby an interior of the refrigerator is isolated from the outside.

In the meantime, when a user draws back the refrigerator door for separating the door 10 from the main body 60, drawing back force is exerted on the combining part 54 by the door liner 30 combined with the refrigerator door 10. Here, the tensile force transferred to the combining part 54 is, in sequence, directly delivered to the air bag 53 formed as one body with the combining part and then to the sticking part 52 formed as one body with the air bag. Accordingly, the sticking part 52 stuck on the refrigerator's main body 60 is separated from the outer case 70 of the main body, whereby a gap between the main body and the door of the refrigerator begins to open.

Lots of requirements are needed for the door gasket with consideration of refrigerator's characteristics. Particularly, among those requirements, insulation property which pre-

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vents cool air from leaking out to the outside and excludes heat flow from the outside by sealing the refrigerator door and main body closed, is strongly needed.

In the meantime, a lateral face of the refrigerator main body 60 is comprised of the outer case 70 constituting an outer wall of the refrigerator; an inner case 80 constituting an inner wall of the refrigerator; a hot-line 90 which is installed at the rear side of the outer case 70 for preventing dewdrop formation on the refrigerator's wall that would be generated by temperature difference between the inside and the outside of the refrigerator. Here, heat generated from the hot-line 90 may be transferred to the outer case 70 and, at the same time, this heat may flow into the interior of the refrigerator main body through an inner path A of the refrigerator, that is, through a gap between the inner case 80 and the door liner 30 of the refrigerator door.

Such heat transfer lowers cooling performance of the refrigerator itself much more, causing a problem that power dissipation increases accordingly. Also, a conventional door gasket 50 as shown in FIG. 2, in which the only sticking part 52 maintaining a predetermined width is stuck on the refrigerator main body 60, prevents outside heat or inside cool air from transferring to and from the refrigerator. Here, after long use of the door gasket, the sticking part 52 get worn out due to frequent opening of the refrigerator door and the sticking part 52 of the door gasket 50 may not be stuck on the outer case 70 of the refrigerator main body when the door 10 is closed on the refrigerator main body 60. Accordingly, closing is not made properly between the door 10 and the main body 6, so that the inside cool air may leak out to the outside of the refrigerator or the outside heat may flow into the inside of the refrigerator.

As is mentioned above, a problem is generated that the cooling performance of the refrigerator is lowered considerably in case that cool air leaks out or outside heat flows into the inside of the refrigerator due to incomplete closing between the refrigerator door and main body.

SUMMARY OF THE INVENTION

An object of the invention is to solve at least the above problems and/or disadvantages, and to provide at least the advantages described hereinafter.

Accordingly, one object of the invention is to provide an obturator for the refrigerator with improved insulation performance.

It is another object of the present invention to provide an obturator for the refrigerator for excluding heat penetration into the interior of the refrigerator by transforming an air bag structure in a door gasket.

It is still another object of the present invention to provide an obturator for the refrigerator for minimizing heat penetration into the interior of the refrigerator by forming projecting portion on at least one of door liner in the refrigerator door or an inner case of a refrigerator main body.

These and other objects and advantages of the invention are achieved by providing an obturator for the refrigerator comprising a door gasket installed on one side of a refrigerator door, having an air bag which could be transformed and rotated freely so that a gap between an inner case and a door liner is closed; a projecting portion formed on at least one of the inner case or the door liner so that the air bag blocks up the gap easily, is provided.

Preferably, an upper part of the air bag is thick in its thickness compared with its bottom. Also, preferably, a propping wall for maintaining a shape of the air bag, is provided on an inner face of the air bag and a first concave

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portion is formed on the one side of the bottom for free transformation and rotation of the air bag, and a second concave portion is formed on one side of an upper part of the air bag for separating the air bag from the sticking part.

The projecting portion may be formed on either a bottom of the inner case or the door liner. Also, the projecting portions may be formed on both the inner case and the door liner with the projecting portions faced opposite each other, and the projecting portions may be formed on above both parts with the projecting portions crossed each other.

According to another aspect of the invention, a door gasket for the refrigerator is provided, mounted on one side of the refrigerator door, and in which the air bag, transformed and rotated freely, is extended long from the lateral portion of the sticking part to the inner face of the refrigerator door, forming one body together with the sticking part. The air bag, preferably, sticks on closely between the inner case and the door liner when the refrigerator is closed.

According to further another aspect of the invention, an obturator for the refrigerator is provided, comprising a projecting portion formed on, at least one of the inner case or the door liner.

According to still another aspect of the invention, a door gasket for the refrigerator is provided, comprising the combining part that is fixed into the combining groove of the door liner; a first air bag that is formed as one body together with the combining part for alleviating impulse exerted upon contact of the refrigerator door and the refrigerator main body; a sticking part that is formed on the first air bag as one body for being stuck on the refrigerator main body by means of the magnet installed within it; a second air bag that is extended long from the lateral portion of the sticking part to the inner face of the refrigerator door, forming one body together with the sticking part, for being transformed and rotated freely.

Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objects and advantages of the invention may be realized and attained as particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

FIG. 1 illustrates the conventional refrigerator door;

FIG. 2 illustrates a door gasket mounted on the door liner of the mullion part partitioning the freezer and the cool chamber in the refrigerator door;

FIG. 3 illustrates a door gasket of the refrigerator in accordance with a preferred embodiment of the present invention;

FIG. 4 illustrates a door gasket of the refrigerator in accordance with another preferred embodiment of the present invention;

FIG. 5 illustrates an application of the door gasket to the door contact part, i.e., the mullion part consisting of the freezer and the cool chamber in the refrigerator in accordance with a preferred embodiment of the present invention;

FIG. 6 is illustrates an application of a door gasket to the door contact part, i.e., the mullion part consisting of the freezer and the cool chamber in the refrigerator in accordance with another preferred embodiment of the present invention;

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FIG. 7 illustrates an application of a door gasket to the outer door contact part, i.e., the case flange part of the refrigerator in accordance with a preferred embodiment of the present invention;

FIG. 8 illustrates an application of a door gasket to the outer door contact part, i.e., the case flange part of the refrigerator in accordance with another preferred embodiment of the present invention;

FIG. 9 illustrates the transformed inner case structure of the refrigerator main body in an obturator for the refrigerator in accordance with another preferred embodiment of the present invention;

FIG. 10 illustrates the transformed door liner structure of the refrigerator door in an obturator for the refrigerator in accordance with another preferred embodiment of the present invention;

FIG. 11 and FIG. 12 illustrate a structure in which both the inner case of the refrigerator main body and the door liner of the refrigerator door are transformed in an obturator for the refrigerator in accordance with another preferred embodiment of the present invention;

FIG. 13 and FIG. 14 illustrate an application of the door gasket to the door contact part, i.e., the mullion part consisting of the freezer and the cool chamber in the refrigerator, and a structure in which the internal path of the refrigerator is transformed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following detailed description will present a preferred embodiment of the invention in reference to the accompanying drawings.

First Embodiment

The first embodiment of the present invention relates to transformation of the air bag of the door gasket mounted and fixed on the refrigerator door, thereby closing the gap between the inside and outside of the refrigerator. FIG. 3 is a drawing illustrating the door gasket of the refrigerator according to a preferred embodiment of the present invention. Referring to FIG. 3, the door gasket 110 of the present invention is comprised of the combining part 111 inserted and fixed in the combining groove 31 of the door liner 30; the first air bag 113 formed as one body together with the combining part 111, for alleviating impulse exerted upon contact of the refrigerator door 10 and the refrigerator main body 60; the sticking part 119 formed on the first air bag 113 as one body together with it, for being stuck on the refrigerator main body 60 by means of the magnet 117 inserted within it; and the second air bag extended long from the lateral portion of the sticking part 119 to the inner face of the refrigerator door 10, forming one body together with the sticking part, for being transformed and rotated freely.

The combining part 111 is of anchor shape for easy insertion and the combining part is firmly inserted and fixed in the combining groove 31 of the door liner so that detachment of the combining part 111 is difficult. The first air bag 113 is for alleviating impulse exerted when the refrigerator door is closed on the refrigerator main body 60 and for preventing the refrigerator door from recoiling to an opposite direction due to the impulse, whereby the sticking part 119 within which the magnet 117 is installed, is stuck on the outer case 70 of the refrigerator main body 60.

The second air bag 115, which is a core part of the present invention, is extended long to the door liner 30 sides in the refrigerator door 10. Here, the second air bag 115 has, preferably, the upper part 127 whose thickness 't' is thin in

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its thickness compared with a thickness T of the bottom part 121 of the second air bag. By making the upper part of the second air bag thin in its thickness, the second air bag may be pushed easily by the refrigerator main body 60 upon contact with the main body. Also, by making the bottom of the second air bag thick in its thickness, the second air bag may not be pushed more than a predetermined extent upon contact with the refrigerator main body, maintaining its shape.

On one side in the bottom of the second air bag, the first concave portion 123 for free transformation and rotation of the second air bag 115 is formed. Accordingly, the second air bag may be transformed or rotated freely upon contact with the refrigerator main body 60 thanks to the first concave portion 123. Namely, the second air bag 115 may be bent easily by means of the first concave portion 123.

On the second air bag, a propping wall 125 for preventing the second air bag from hanging down at ordinary times and maintaining its shape more firmly, may be provided to its inner face.

As the magnet is installed within the sticking part 119, the refrigerator door 10 is stuck on the refrigerator main body 60. In case of applying the second air bag 115 of the door gasket 110 described above, there may be generated a problem that when the door is closed, the second air bag is pushed by the inner case, with the sticking part 119 opened accordingly, whereby closing on the main body is not performed well. In order to resolve this problem, the second air bag of the door gasket 110 may be transformed in its structure as shown in FIG. 4.

FIG. 4 is a drawing illustrating the door gasket of the refrigerator according to another preferred embodiment of the present invention. Referring to FIG. 4, the second air bag 115 has the second concave portion 129 on one side of its upper portion 127 so that the sticking part 119 may not push the air bag. By the second concave portion 129, the sticking part 119 is spaced from the second air bag and even in case that the second air bag is pushed, such pushing has no influence on the sticking part 119. Accordingly, thanks to formation of the second concave portion 129, the sticking part 119 maintains its sticking on the main body regardless of pushing of the second air bag 115. In short, the second concave portion 129 is formed for independent transformations of the sticking part 119 and the second air bag 115.

Application of the door gasket of the refrigerator mentioned above to the refrigerator door will be described herein below with reference to FIG. 5 through FIG. 8.

FIG. 5 and FIG. 7 are drawings illustrating applications of the door gasket of the refrigerator to the door contact part (mullion part) consisting of the freezer and the cool chamber of the refrigerator, and to the outer door contact part (case-flange part) of the refrigerator, respectively, in accordance with a preferred embodiment of the present invention. Referring to FIG. 5 and FIG. 7, in case that the refrigerator door 10 on which the door gasket of the refrigerator according to a preferred embodiment of the present invention is mounted and fixed, is closed on the refrigerator main body 60, the second air bag blocks up the internal path, i.e., the gap between the inner case 80 of the refrigerator main body 60 and the door liner 30 of the refrigerator door 10. Here, the second air bag 115 is transformed or rotated up and down freely thanks to the first concave portion 123 though the internal path A is different in its structure.

FIG. 6 and FIG. 8 are drawings illustrating application of the door gasket of the refrigerator to the door contact part (mullion part) consisting of the freezer and the cool chamber of the refrigerator, and to the outer door contact part (case

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flange part) of the refrigerator, respectively, in accordance with another preferred embodiment of the present invention. As is shown in FIG. 6 and FIG. 8, in case that the refrigerator door 10 is closed, the second air bag blocks up the internal path, i.e., the gap between the inner case 80 of the refrigerator main body 60 and the door liner 30 of the refrigerator door 10. Also, the second air bag has the second concave portion 129 on one side of its portion, so that a problem that the second air bag is transformed due to the sticking part 119 and the internal path A is not blocked up properly, is prevented in advance though the sticking part 119 is worn out and pushed to the side of the second air bag. Furthermore, thanks to formation of the second concave portion 129 the second air bag may move to right and left freely.

Second Embodiment

The second embodiment of the present invention relates to minimization of the gap between the inner case of the refrigerator main body and the door liner of the refrigerator door and to lengthening of a heat transfer path that passes through an inner case ABS resin and a door liner wall, thereby restraining cool air or heat transfer moving to and from the refrigerator.

As illustrated in FIG. 9, a structure which narrows the internal path A is achieved by forming the projecting portion 131 projected to a side of the refrigerator door liner, on one side of the inner case 80 of the refrigerator main body 60. Here, the projecting portion 131 may be formed on anywhere on one side of the inner case.

As illustrated in FIG. 10, another structure which narrows the internal path A may also be achieved by projecting the door liner 30 of the refrigerator door 10. Namely, the projecting portion 133 projected to a side of the inner case 80, is formed on one side of the door liner 30.

As illustrated in FIG. 11, further another structure which narrows the internal path A may also be achieved by forming projection portions 131 and 133 such that each projecting portion is projected both from the inner case 80 and the door liner 30, respectively, with each projecting portion faced opposite each other.

As illustrated in FIG. 12, still further another structure which narrows the internal path A may also be achieved by forming projection portions 131 and 133 such that each projecting portion is projected both from the inner case 80 and the door liner 30, respectively, with each projecting portion crossed each other.

As illustrated in FIG. 11 and FIG. 12, the projecting portions 131 and 133 may be formed so that each projecting portion both from the inner case 80 and the door liner 30 is faced opposite or crossed each other, whereby heat or cool air can be cut off more effectively.

In FIG. 9 through FIG. 12, the projecting portions 131 and 133 are preferably formed wide in its width W for increasing a heat transfer resistance regarding the heat or the cool air that passes through the internal path A. Also, in FIG. 9 through FIG. 12, the projecting portions 131 and 133 are preferably formed close to the side of the door liner 30 of the refrigerator door 10 so that the internal path A is formed narrow as much as possible. Of course, the projecting portions 131 and 133 should be formed so that they may not be barred by the door liner 30 when the refrigerator door is closed on the refrigerator main body.

The projecting portions 131 and 133 formed in FIG. 9 through FIG. 12, can be manufactured simply upon formation of the inner case 80 and the door liner 30 and also they can be formed on an invisible portion. Accordingly, appearance of the refrigerator is not spoiled very much while heat or cool air can be cut off effectively.

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Third Embodiment

A third embodiment of the present invention relates to more definite obturation of the inside and outside of the refrigerator by applying the first embodiment and the second embodiment. Namely, the third embodiment blocks up the internal path A using the second air bag of the door gasket, making the internal path narrow using the projecting portion, thereby cutting off heat or cool air completely, improving cooling performance to the maximum extent.

FIG. 13 and FIG. 14 are drawings illustrating a transformed structure for the internal path of the refrigerator with application of the door gasket according to a preferred embodiment of the present invention, to the door contact part (mullion part) consisting of the freezer and the cool chamber of the refrigerator.

As illustrated in FIG. 13 and FIG. 14, the second air bag 115 is extended long to the side of the door liner 30; and at the same time, the door gasket 110 on which the first concave portion 123 for free transformation and rotation of the air bag and the second concave portion 129 for separating the sticking part 119 from the second air bag 115 are formed respectively; and the projecting portions 131 and 133 for narrowing the internal path A, are provided together to the door 10 and main body 60 of the refrigerator. Accordingly, a first obturation is made by the second air bag 115 and, simultaneously, a second obturation is made by the projecting portions 131 and 133 for narrowing the internal path, so that complete obturation is accomplished, cooling performance is improved to the maximum extent, and power dissipation is lowered very much accordingly.

Here, in order that the second air bag 115 blocks up the internal path, the projecting portions 131 and 133 are preferably formed on the bottom of the inner case 80 or the door liner 30, more exactly, on a portion, predetermined part of which is overlapped by the second air bag 115 when the door 10 is closed.

In the foregoing, though the third embodiment is described with a limited application of the door gasket to the mullion part, it is needless to say that the third embodiment can be applied to the case-flange part, i.e., a lateral part consisting of the freezer and the cool chamber.

As is apparent from the above descriptions, according to the obturator for the refrigerator of the present invention, the internal path is blocked up by transformation of the air bag in the door gasket, whereby inflow of heat from the outside or from the hot-line into the inside of the refrigerator and leakage of the inside cool air of the refrigerator out to the outside, are cut off and cooling performance is improved accordingly.

Furthermore, according to the obturator for the refrigerator of the present invention, projecting portion is formed on either the inner case or door liner for narrowing the internal path, whereby the heat transfer resistance regarding the inside cool air or the outside heat of the refrigerator is increased to the maximum extent and cooling performance is improved accordingly.

Also, according to the obturator for the refrigerator of the present invention, though the sticking part of the door gasket get old and worn out, the air bag blocks up the internal path of the refrigerator secondly, thereby cutting off the heat transfer generated from the hot-line as well as cutting off completely the heat transfer or cool air transfer to and from the refrigerator, improving insulation performance remarkably and lowering power dissipation of the refrigerator very much accordingly.

Therefore, according to the obturator for the refrigerator of the present invention, as transformations of the air bag in

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the door gasket and of projecting portion for narrowing the internal path are made simultaneously, completed obturation is achieved, whereby it is expected that cooling performance is improved to the maximum extent while power dissipation is lowered considerably.

The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The present teaching can be readily applied to other types of apparatuses. The description of the invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art.

What is claimed is:

1. An obturator of a refrigerator having a refrigerator main body with an outer case and an inner case constituting an outer wall and an inner wall in the refrigerator, respectively, and a refrigerator door, which is opened and closed on the refrigerator main body and on which a door liner is provided opposite to the inner case, the obturator comprising:

a door gasket for the refrigerator, wherein the door gasket includes a transformable and freely rotatable air bag that is configured to be mounted on one side of the refrigerator door of the refrigerator, wherein the air bag is configured to extend from a lateral portion of a sticking part to an inner face of the refrigerator door, where the airbag and the sticking part form one body, wherein the inner case includes a first surface corresponding to a surface contacting the outer case, and a second surface bent from the first surface, and wherein at least one portion of the air bag is configured to be accommodated in a predetermined gap defined between the second surface and the door liner of the refrigerator door so as to block up the predetermined gap.

2. The obturator of a refrigerator according to claim 1, wherein the air bag blocks up the predetermined gap between the second surface and the door liner when the refrigerator door is closed.

3. The obturator of a refrigerator according to claim 1, wherein an upper portion of the air bag is thin in a thickness of the air bag compared with a bottom of the air bag.

4. The obturator of a refrigerator according to claim 1, wherein a propping wall is equipped for maintaining a shape on an inner face of the air bag.

5. The obturator of a refrigerator according to claim 1, wherein a concave portion is formed for free transformation and rotation of the air bag on one side of a bottom of the air bag.

6. The obturator of a refrigerator according to claim 1, wherein a concave portion is formed for separation of the air bag from the sticking part on one side of an upper portion of the air bag.

7. An obturator of a refrigerator having a refrigerator main body with an outer case and an inner case, respectively, constituting an outer wall and an inner wall of the refrigerator main body, and a refrigerator door which is opened and closed on the refrigerator and which has a door liner provided on a mullion part to oppose the inner case, the inner case and the door liner defining a space, the obturator comprising:

a door gasket, comprising:

a first air bag; and
a second air bag, wherein the second air bag is positioned laterally of the first air bag, wherein the inner case includes a first surface corresponding to a surface contacting the outer case, and a second surface bent from the first surface, and wherein the first air bag is configured to contact only the outer

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case of the refrigerator main body while the second air bag is configured to contact only the second surface when accommodated in the space, wherein a concave portion is formed on one side of the second air bag which faces the door liner, and wherein only an upper part of the concave portion of the second airbag is accommodated in the space.

8. The obturator of claim 7, further comprising a sticking part attached to the first air bag so that the sticking part sticks to only the outer case.

9. The obturator of claim 7, wherein the portion of the bag with the concave portion is thicker than the portion of the bag without the concave portion.

10. An obturator of a refrigerator having a refrigerator main body with an outer case and an inner case, respectively, constituting an outer wall and an inner wall of the refrigerator main body, and a refrigerator door having a door liner on a mullion part opposing the inner case, the inner case and the door liner defining a space, the obturator comprising:

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a first air bag; and

a second air bag, wherein the first and second air bags are formed as one body, wherein the inner case includes a first surface corresponding to a surface contacting the outer case, and a second surface bent from the first surface, and wherein a concave portion is formed on one side of the second air bag which faces the door liner, and wherein only an upper part of the concave portion of the second air bag is seated in the space defined between the second surface and the door liner to block the space.

11. The obturator of claim 10, further comprising a sticking part attached to the first air bag so that the sticking part sticks to only the outer case.

12. The obturator of claim 10, wherein a portion of the bag with the concave portion is thicker than a portion of the bag without the concave portion.

* * * * *

EXHIBIT 10



US005269601A

United States Patent [19][11] **Patent Number:** 5,269,601

Williams et al.

[45] **Date of Patent:** Dec. 14, 1993[54] **METHOD AND APPARATUS FOR
MANUFACTURE OF PLASTIC
REFRIGERATOR LINERS**[75] **Inventors:** Stephen G. Williams, Ohio
Township, Warrick County, Ind.;
David L. Schwartz, Ft. Smith, Ark.[73] **Assignee:** Whirlpool Corporation, Benton
Harbor, Mich.[21] **Appl. No.:** 880,859[22] **Filed:** May 11, 1992[51] **Int. Cl.⁵** A47B 81/00[52] **U.S. Cl.** 312/406.1[58] **Field of Search** 312/406, 406.1, 407;
220/467, 440[56] **References Cited****U.S. PATENT DOCUMENTS**

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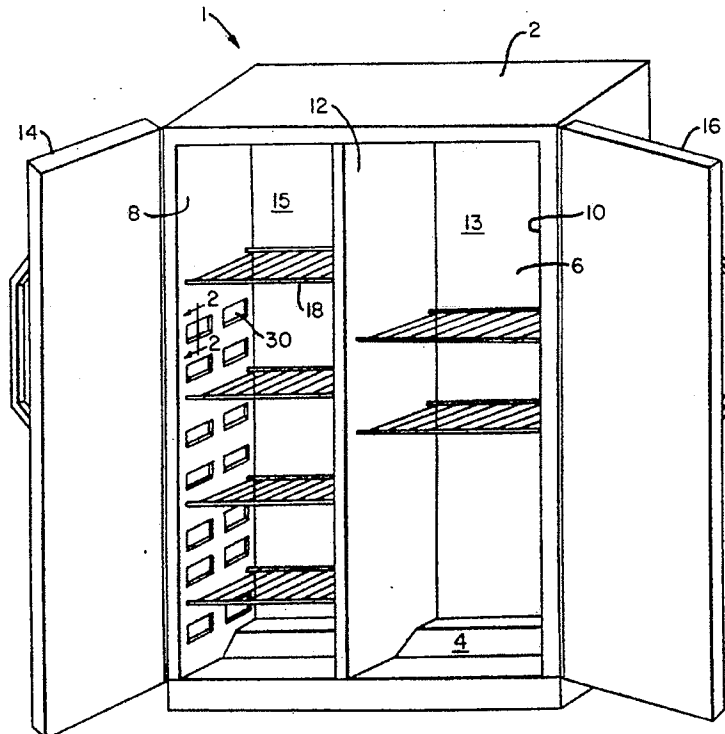
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Primary Examiner—Rodney M. Lindsey**Attorney, Agent, or Firm**—Thomas J. Roth; Stephen D. Krefman; Thomas E. Turcotte[57] **ABSTRACT**

Plaques are formed on the sidewalls of the liner in a refrigerator to reduce thermally induced bowing of the cabinet. The plaques may consist of indentations in the liner, which in a preferred form are rectangular, or arrays of multiplanar indentations. The plaques provide increased surface area in the liner to permit thermal expansion without bowing, and also increase the structural rigidity of the liner to resist bowing. Thermal bowing is encountered where there are long unsupported wall surfaces and high temperature gradients across the wall. Therefore the plaques are very effective in the freezer compartment of a side-by-side refrigerator, where bowing can be severe in the absence of the disclosed corrective measure.

25 Claims, 6 Drawing Sheets

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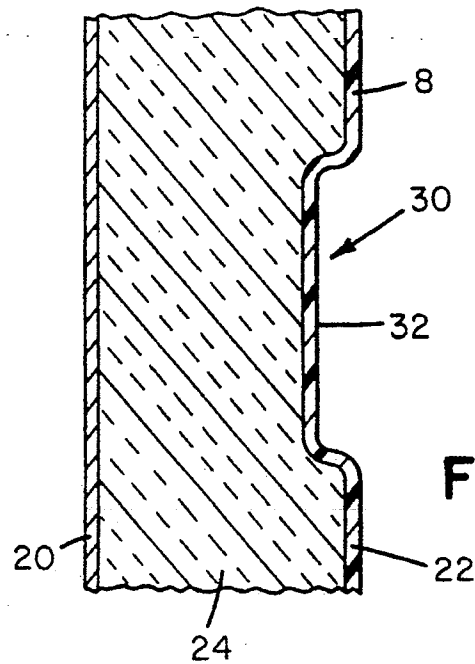


FIG. 2

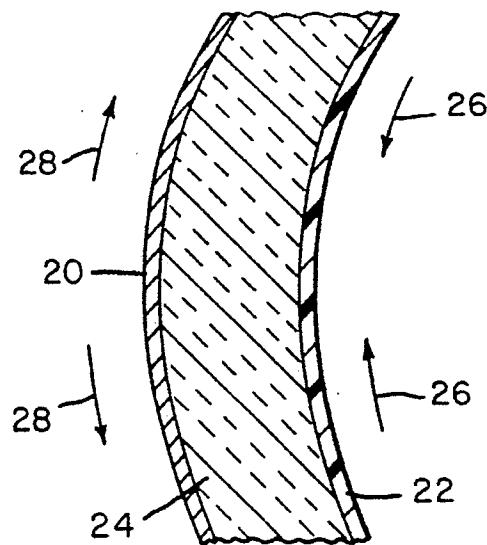
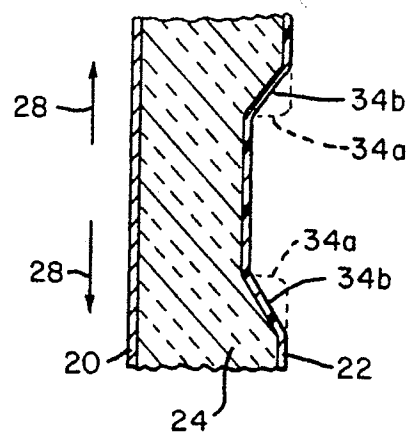
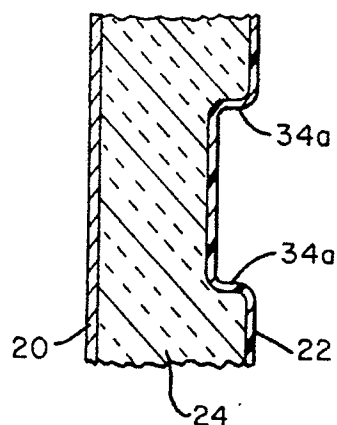
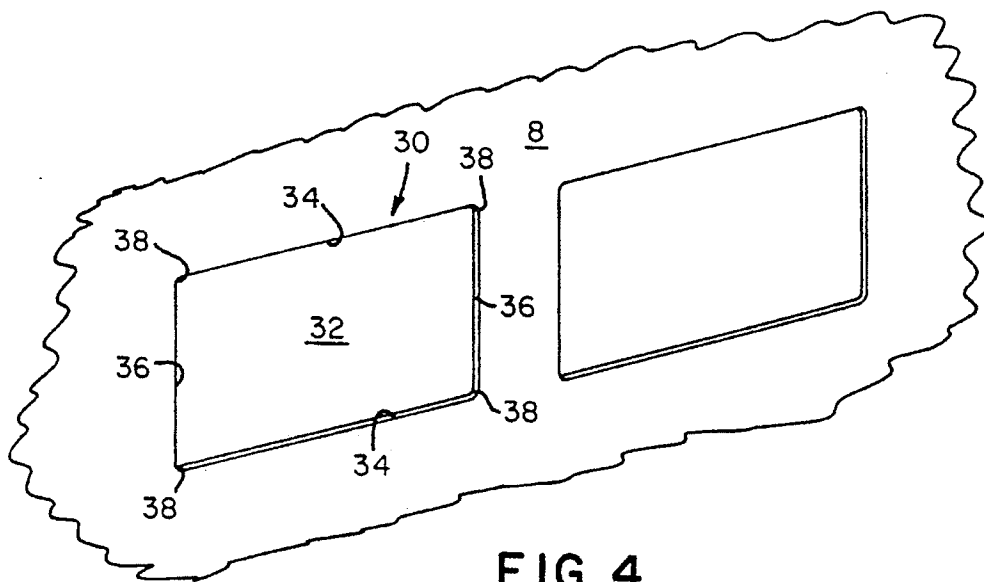


FIG. 3



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FIG. 6

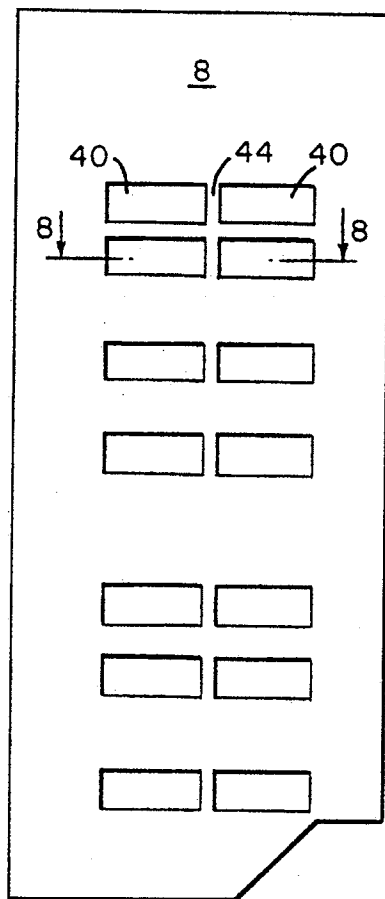


FIG. 7

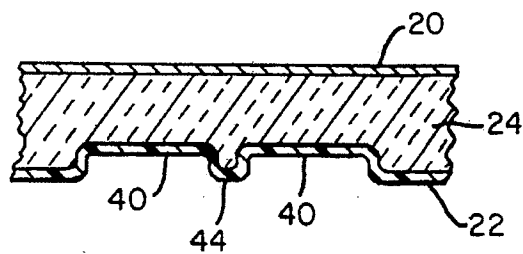
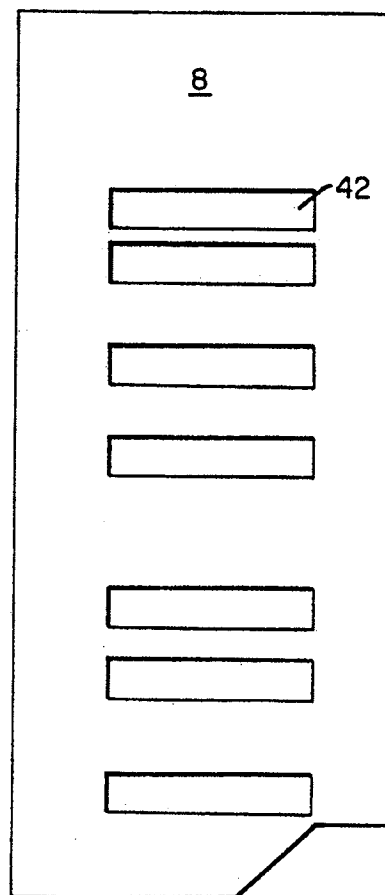


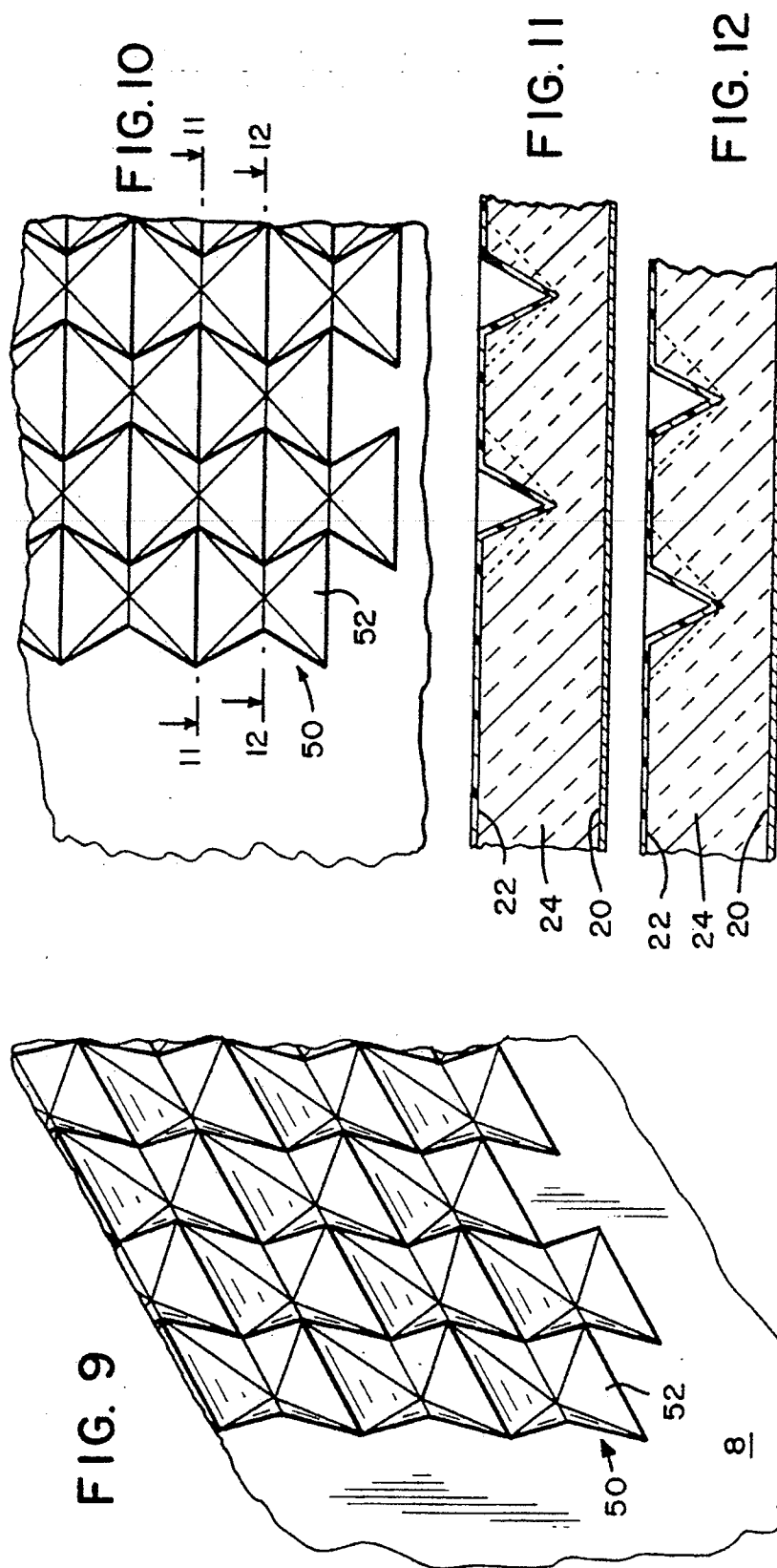
FIG. 8

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FIG. 14

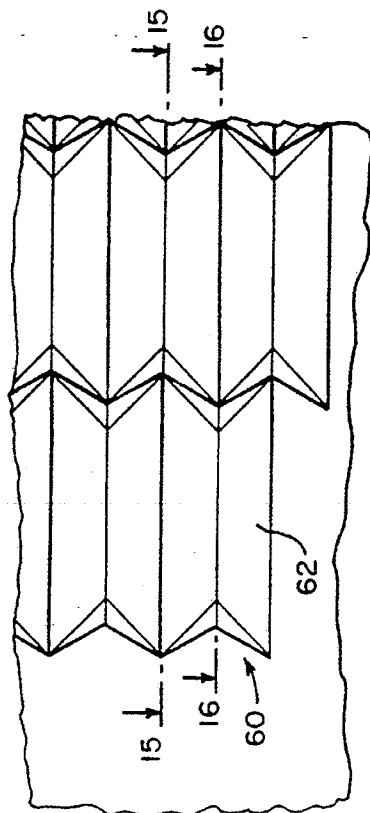


FIG. 15

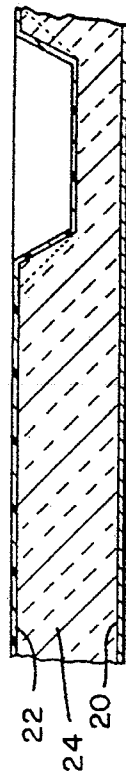
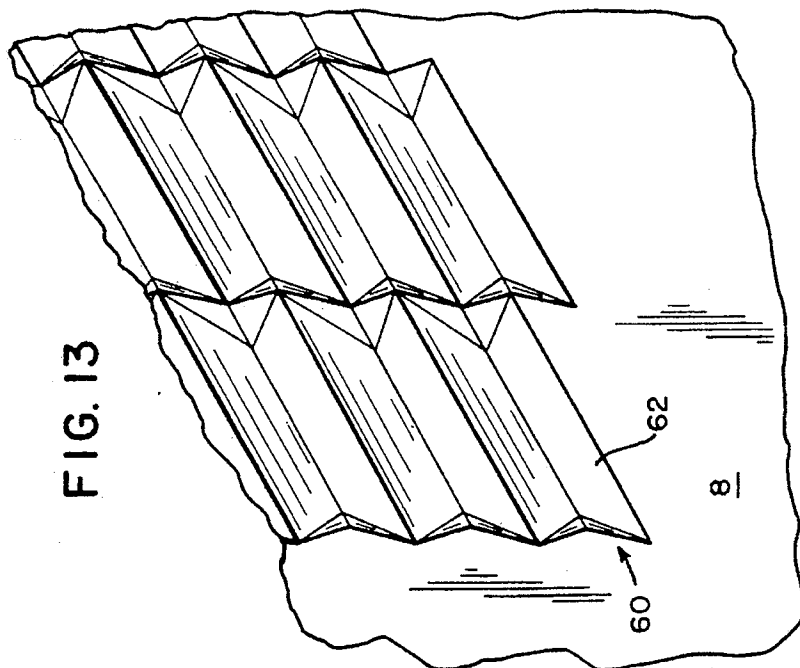


FIG. 16



FIG. 13



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METHOD AND APPARATUS FOR MANUFACTURE OF PLASTIC REFRIGERATOR LINERS

BACKGROUND

1. Field Of The Invention

The present invention relates to a domestic refrigerator with "plaques" formed in the refrigerator cabinet walls to prevent thermal bowing of the cabinet.

2. Description Of The Prior Art

A current state of the art domestic refrigerator cabinet consists of an exterior prepainted steel shell, an interior plastic liner for dividing the cabinet interior into a fresh food compartment and a frozen food compartment, and a layer of foam between the metal shell and the plastic liner which acts as thermal insulation and provides structural rigidity to the refrigerator cabinet.

The inner liner may be formed to provide any of the common refrigerator configurations, including the top-mount type in which a horizontal separator divides the unit into an upper frozen food compartment and a lower fresh food compartment, the bottom-mount type which is essentially the inverse of the top-mount type, and the side-by-side type in which a central vertical separator divides the unit into side by side fresh and frozen food compartments.

Thermal bowing of the cabinet sidewalls is a serious problem in the above described refrigerator cabinets. It is believed that the temperature gradient which exists across the cabinet wall produces a bi-material effect, where the various materials in the cabinet wall expand or contract by a different amount in response to the temperature gradient. The interior plastic liner is exposed to the cooled interior of the refrigerator compartments, and the liner surface therefore tends to contract slightly. The exterior shell is exposed to a warm ambient temperature, and therefore tends to expand. Although the liner and shell surfaces respond differently to the thermal effects, they are locked together by the foam layer and may not move freely with respect to one another. As a result, the cabinet sidewalls tend to bow outward to compensate for the expansion and contraction of the different layers of the walls.

The bowing is generally more severe in cabinet walls adjacent to the frozen food compartment than in those adjacent to the fresh food compartment due to the greater temperature gradient across the freezer compartment walls. Side-by-side refrigerators are more susceptible to cabinet bowing than top-mount or bottom-mount cabinets because the side-by-side cabinet is divided vertically by a compartment separator wall, and lacks the horizontal divider of the top- or bottom-mount which to some extent ties the cabinet sidewalls together. Bowing of the cabinet sidewalls is of particular concern because the compartment shelves are sometimes mounted between the opposed sidewalls of the compartment, and when the cabinet bow is excessive the shelves are unable to span the increased distance and may collapse. Other detrimental effects of cabinet bowing include misalignment of the cabinet doors and door seals, misactivation of door-actuated switches, and increased energy consumption due to air leakage around the doors.

It is generally known in the art that refrigerator liners may have various forms of embossing and indentations for purposes such as to cover manufacturing imperfections in refrigerator liner sidewalls, to provide incre-

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mental increases in refrigerator volume, or to provide enhanced visual aesthetics in the refrigerator liner. However, it was not known previously that the presently disclosed plaques may be used to prevent cabinet bowing. U.S. Pat. No. 2,028,943 (Money) discloses a stamped metal refrigerator liner with raised ridges to increase the rigidity of the sidewalls, however this patent is not directed to reducing deformation of the entire cabinet wall. U.S. Pat. No. 4,053,972 (Kordes) shows a refrigerator door with apparently decorative rectangular liner indentations. U.S. Pat. No. 4,498,713 (Fellwock et al) discloses horizontal and vertical stress-relief ribs in a refrigerator cabinet liner. U.S. Pat. No. 4,914,341 (Weaver et al) discloses that horizontal ribs in a refrigerator door liner are effective to reduce door liner stress.

SUMMARY OF THE INVENTION

To overcome the problem of thermally-induced cabinet bowing, plaques are formed on the plastic inner liner. Each plaque consists of an indentation in the plastic inner liner in the direction of the foam insulation layer. The plaques are preferably rectangular in shape, and may be located in various configurations on the liner to avoid interfering with shelves and other mechanical components. Alternately, the plaques may consist of arrays of multiplanar indentations arranged on the liner surface.

It is believed that a combination of physical factors contribute to the effectiveness of the plaques at resisting cabinet bowing. First, the plaques increase the surface area of the liner, and the plaque edges act as small hinges, permitting planar surface expansion without causing bowing of the cabinet sidewall. Also, the plaques increase the structural rigidity of the liner and therefore resist thermal bowing.

The preferred embodiment of the present invention includes horizontally aligned pairs of rectangular plaques vertically spaced along the liner sidewall and compartment separator wall in the frozen food compartment of a side-by-side refrigerator. The horizontally aligned pairs of plaques are separated by a narrow vertical channel formed in the liner. Computer-simulated structural testing confirms that the narrow vertical channel provides increased structural rigidity and further resists thermal bowing deformation in the horizontal and vertical directions.

The plaques are also useful in preventing cabinet bowing in the fresh food compartment of a side-by-side refrigerator, as well as in the fresh and frozen food compartments of top-mount and bottom-mount refrigerator cabinets.

DESCRIPTION OF THE DRAWING

FIG. 1 is a front perspective view of a domestic side-by-side refrigerator with liner plaques formed in the sidewalls of the freezer compartment;

FIG. 2 is a partial vertical sectional view through one of the plaques in the exterior wall of the refrigerator cabinet along line 2—2 of FIG. 1;

FIG. 3 is a partial vertical sectional view through one of the exterior walls of an unplaqued refrigerator cabinet illustrating in exaggerated scale the effects of thermally-induced cabinet bowing;

FIG. 4 is a partial perspective view of the liner of a domestic refrigerator showing liner plaques formed in accordance with the present invention;

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FIGS. 5(a) and 5(b) are partial vertical sectional views through one of the exterior walls of the plaqued refrigerator cabinet illustrating in exaggerated scale the expansion-joint effect of the plaque in response to thermal forces, with FIG. 5(a) illustrating the normal configuration of the plaque without expansion forces, and FIG. 5(b) illustrating the absorption of surface expansion forces without bowing;

FIG. 6 is an elevational view of one sidewall of the frozen food compartment liner in a side-by-side refrigerator showing the preferred embodiment for the placement of plaques on the wall;

FIG. 7 is an elevational view of the frozen food compartment liner in a side-by-side refrigerator showing an alternate embodiment for the placement of plaques on the wall;

FIG. 8 is a partial horizontal sectional view of the preferred embodiment of FIG. 6 along line 8—8;

FIG. 9 is a partial perspective view of a refrigerator liner showing a first embodiment of an array of multiplanar formations to prevent refrigerator cabinet bowing;

FIG. 10 an elevational view of a portion of an array of multiplanar formations of the type comprising the array of FIG. 9;

FIG. 11 is a sectional view along line 11—11 of FIG. 10;

FIG. 12 is a sectional view along line 12—12 of FIG. 10;

FIG. 13 is a partial perspective view of a refrigerator liner showing a second embodiment of an array of multiplanar formations to prevent refrigerator cabinet bowing;

FIG. 14 an elevational view of a portion of an array of multiplanar formations of the type comprising the array of FIG. 13;

FIG. 15 is a sectional view along line 15—15 of FIG. 14;

FIG. 16 is a sectional view along line 16—16 of FIG. 14;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a side-by-side refrigerator cabinet 1 consisting of several wall portions, including a top wall 2, a bottom wall 4, a back wall 6, first and second side walls 8 and 10, a compartment separator wall 12 located between the exterior side walls for dividing the cabinet interior into a fresh food compartment 13 and a frozen food compartment 15, and hinged doors 14 and 16 for closing the open fronts of the compartments. A number of shelves 18 are typically mounted in the compartments between the opposed sidewalls of each compartment. The shelves are mounted by any suitable means, such as by mounting structures, or socket structures protruding from the sides of the compartment walls.

Each of the exterior walls is a multi-layered structure 15 similar to that shown in FIG. 2, which shows a cross section of the freezer compartment sidewall 8 along line 2—2 of FIG. 1. The exterior layer 20 is typically a pre-painted steel shell which forms the exterior wrapper for the cabinet. The interior layer 22 is a plastic thermoformed liner made of high-impact polystyrene (HIPS) or other suitable material. The space between the steel shell and the plastic liner is filled with rigid foam insulation 24. The foam is initially deposited in the space in liquid form, and it then expands to fill the space. The foam eventually hardens and locks the inner liner to the

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outer shell, providing thermal insulation and structural support for the cabinet walls.

A sealed refrigeration system, generally consisting of a compressor and one or more heat exchange units, is provided to cool the fresh and frozen food compartments to temperatures suitable for the storage of food items. The frozen food compartment 15 is maintained at a temperature well below the freezing point of water, and the fresh food compartment 13 is maintained at a temperature slightly higher than the freezing point of water. Therefore, the differences between the refrigerated compartment temperatures and the room ambient temperature creates a significant temperature differential across the exterior refrigerator cabinet walls, and also across the interior cabinet wall which separates the fresh food and frozen food compartments.

With this significant temperature differential, the refrigerator cabinet walls may be subject to thermally-induced bowing. As illustrated in FIG. 3 in exaggerated scale for clarity, the bi-material effect resulting from the different thermal properties of the cabinet wall materials causes the cooled surface of the interior liner 22 to contract slightly, as indicated by arrows 26, and in response to the relatively warm room ambient temperature causes the surface of the exterior shell 20 to expand slightly, as indicated by arrows 28. As a result, the cabinet sidewalls tend to bow outward. Refrigerator cabinet wall bowing of $\frac{1}{2}$ inch has been observed, and may result in numerous problems in the product operation.

Plaques 30 are formed into the side walls of the refrigerator cabinet to resist thermal bowing of the cabinet walls due to the temperature gradient across the side walls. As shown in FIG. 4, the plaques consist of indentations in the plastic inner liner which may be formed simultaneously with the thermoforming of the plastic liner. The plaques are generally rectangular in shape, and have a rectangular planar face 32 offset from the general plane of the plastic liner. Each plaque is bounded by a pair of horizontal edges 34 and a pair of vertical edges 36 which are radiused to provide a smooth transition between the surface of the liner and the surface of the plaque face. The corners 38 of each plaque are rounded to eliminate surface stress on the liner and for improved aesthetics.

The plaque configuration is incorporated into the liner thermoform tooling so that the liner 22 and plaques 30 are formed in a single manufacturing step. The liner 22 is then inserted into the formed exterior shell 20, and liquified foam is placed in the space between the liner and shell. The foam 24 expands and hardens in the space, filling the area between the shell, the liner, and the plaques. The rectangular face 32 and the edge portions 36 and 38 of the plaques are surrounded by the foam, as shown in FIG. 2. The resulting refrigerator cabinet is a unitary structural assembly, with the liner, foam, and shell firmly locked together.

It is believed that a number of factors combine to make the resulting plaqued refrigerator cabinet uniquely resistant to thermally-induced bowing. Rather than focus solely on the effect of the plaques on the liner, it is important to view the plaques as they relate to the liner, the foam, and the shell as a unitary structural assembly.

First, the horizontal and vertical edge portions of the plaques, 34 and 36 respectively, function as small expansion joints between the liner surface and the plaque surfaces, and are able to compensate for surface con-

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traction and expansion without causing surface bowing. FIG. 5(a) illustrates the refrigerator wall configuration in the vicinity of the plaque in its unstressed configuration. As the exterior shell 20 expands, forces 28 are transmitted through the foam layer 24 to the liner 22, creating tension on the liner surface. FIG. 5(b) illustrates in exaggerated scale for clarity that the plaque edges are able to flex slightly from their original configuration 34a to an extended configuration 34b to relieve the surface tension on the liner. Expansion and contraction of the entire cabinet wall assembly can then take place without bowing.

Test results confirm that the plaques are effective as expansion joints to relieve liner surface tension. Table 1 below shows the results of tensile deflection testing on samples of plaqued and unplaqued HIPS refrigerator liners. The unplaqued samples exhibited yield forces which averaged 146,000 psi at 1% tensile deflection. The plaqued samples exhibited yield forces which averaged 32,000 psi at 1% tensile deflection. Because the plaqued liner samples have only 22% of the internal stiffness of the flat unplaqued liner samples, the plaqued material is more resistant to cabinet bowing due to the reduction of internal liner wall stiffness.

TABLE 1

TENSILE DEFLECTION TESTING OF PLAQUED AND UNPLAQUED HIPS LINER SAMPLES		
Sample Configuration	Tensile Deflection	Yield Force (psi)
Unplaqued HIPS	1%	146,000 psi
Plaqued HIPS	1%	32,000 psi

Second, the plaqued liner surface 22 is itself inherently more structurally rigid than a comparable unplaqued piece of the same material. The plaque edge portions are angularly offset from the planes of the liner and plaque surfaces, forming beam structures on the liner surface. The horizontal and vertical pairs of plaques edges, 34 and 36 respectively, thus resist bowing about the horizontal and vertical axes of the liner due to this beam effect. When the liner is bonded to the foam 24 and steel shell 20, the entire structural assembly is then more rigid and resistant to bowing.

The plaques 30 then serve both as a structural stiffener to resist bowing deformation, and as liner internal tension relief elements. The physical configuration of the plaques determines their effectiveness in preventing deformation.

Computer finite element analysis testing indicates that the degree of cabinet bowing is inversely proportional to the distance by which the plaque surface is offset from the surface of the liner. Table 2 indicates the relationship between liner plaque depth and percentage decrease of cabinet deformation for a plaque configuration as shown in FIG. 7 compared to an unplaqued liner. A plaque depth of 1/16 inch resulted in a 14.6% decrease in wall deformation over an unplaqued wall, while a plaque depth of 1/8 inch resulted in a 17.8% decrease in wall deformation. The testing suggests that increasing the plaque depth beyond 1/8 inch, or possibly deeper, would result in further incremental improvements in the resistance to wall deformation. However, these greater plaque depths have not been tested, and may require more significant modification to the liner tooling.

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TABLE 2

EFFECT OF PLAQUE DEPTH ON CABINET WALL DEFORMATION		
Liner Configuration	Plaque Depth (inches)	Percent Decrease In Wall Deformation
Unplaqued	0.0	0.0%
Plaqued	0.0625	14.6%
Plaqued	0.1250	17.8%

The preferred embodiment of a refrigerator cabinet with liner plaques is shown in FIG. 6. It has been determined that providing horizontally aligned pairs of plaques spaced vertically along the liner wall as shown in FIG. 6 increases the resistance to deformation over a liner having larger single plaques spaced vertically along the wall, as shown in FIG. 7. The preferred embodiment of FIG. 6 is nearly identical to the configuration of FIG. 7, except that the large plaques 42 of FIG. 7 are divided into horizontally-aligned pairs 40 in FIG. 6 by the vertical "channel" 44 formed in the liner. The improved bowing resistance of the preferred embodiment is believed to result from the structural rigidity of the vertical liner channel 44 between the aligned pairs of plaques 40 running the length of the liner wall.

Channel 44 is an uninterrupted planar vertical strip of liner material which separates the individual plaques 40 in each of the horizontally aligned plaque pairs. In the cross-section view shown in FIG. 8, the channel 44 is coplanar with the general plane of the refrigerator liner 8 beyond plaques 44, although the channel may also conceivably be offset from the general plane of the liner.

Table 3 indicates the dramatic decrease in wall deformation resulting from the provision of the vertical channel of FIG. 6. The liner configuration of FIG. 7 with a plaque depth of 1/8 inch provides a 17.8% decrease in wall deformation over an unplaqued liner. The liner configuration of FIG. 6, which has a plaque depth of 1/8 inch and vertical spacing of plaques similar to that of FIG. 7, but with the addition of the vertical channel 42 splitting the plaques into horizontally aligned pairs 40, provides a 31% decrease in wall deformation over an unplaqued liner.

TABLE 3

EFFECT OF VERTICAL CHANNEL ON CABINET WALL DEFORMATION	
Liner Configuration	Percent Decrease In Wall Deformation
Unplaqued	0.0%
Plaqued, no channel	17.8%
Plaqued with channel	31.0%

FIGS. 9 through 16 are directed to a different type of structure for reducing bowing in a refrigerator cabinet. Both FIGS. 9 and 13 show arrays 50 and 60, respectively, of adjacent identical multiplanar indentations 52 and 62, respectively, in the liner surface 8. FIG. 10 shows how the individual multiplanar indentations 52 fit together to make up the array of FIG. 9. The structure of FIG. 10 consists of 6 planar surfaces which form a hybrid pyramid shape projecting into the foam layer of the refrigerator cabinet wall. FIGS. 11 and 12 are sectional views through the refrigerator cabinet along lines 11—11 and 12—12, respectively, of FIG. 10, and show the details of the liner profile.

FIG. 13 shows an array 60 of differently shaped indentations 62 in liner surface 8. FIG. 14 shows how the

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individual multiplanar indentations 62 fit together to make up the array of FIG. 13. The indentation 62 of FIG. 14 consists of 6 planar surfaces which form an elongated hybrid pyramid shape projecting into the foam layer of the refrigerator cabinet wall. FIGS. 15 and 16 are sectional views through the refrigerator cabinet along lines 15—15 and 16—16, respectively, of FIG. 14, and show the details of the liner profile.

In each version of the multiplanar formations shown in FIGS. 9, 10, 13 and 14, the various planar surfaces which comprise the multiplanar formation are capable of flexure with respect to one another about their adjacent edges to absorb thermally induced expansion and contraction of the refrigerator wall structure without bowing. As can be seen from the orientations of the various edges, these formations are capable of flexure in response to diagonal forces as well as horizontal and vertical forces. Arrangement of the individual multiplanar formations in arrays multiplies the effect of the individual structures.

The arrays may be placed in an arrangement similar to the rectangular plaques of FIGS. 6 and 7 to avoid interference with shelf structures and other mechanical components mounted on the refrigerator liner.

The discussions provided in this specification are primarily directed to the use of plaques on side-by-side domestic refrigerators where the problems of cabinet bowing are severe. However, it should be understood that the present invention is not intended to be limited to side-by-side refrigerators, or to domestic refrigeration products in general, and may be useful to resist thermal bowing in a broad array of applications. It is also to be understood that, in light of the above teachings, the preferred configuration of the invention described in this specification is susceptible to various changes of form, proportions, and details of construction, all of which are intended to fall within the scope of the appended claims.

What is claimed is:

1. Thermally-induced bowing reduction means for an insulating wall structure, wherein said wall structure comprises bonded-together layers of an exterior metal shell, an intermediate rigid foam insulating layer, and an interior planar plastic layer, wherein said bowing reduction means comprises at least one plaque formed on said interior plastic layer, said plaque comprising:

a planar surface integrally formed with said interior plastic layer and offset from the plane of said interior plastic layer in the direction of said foam layer by a predetermined distance; and

edge portions defining the boundaries of said planar surface and extending between the planar surface of said plaque and the plane of said interior plastic layer, said edge portions providing:

expansion joints between the plane of said interior plastic layer and the plane of said planar surface such that said edge portions are capable of flexure to absorb thermally-induced contraction and expansion of the interior plastic layer, and

beam elements on said interior plastic layer preventing bowing of said interior plastic layer; said intermediate foam insulating layer closely embracing said edge portions.

2. The bowing reduction means of claim 1 wherein said planar surface of each plaque is generally rectangular in shape.

3. The bowing reduction means of claim 1 wherein said planar surfaces of said plaques are offset from the

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plane of said interior plastic liner by between 0.0625 and 0.25 inches.

4. The bowing reduction means of claim 2 comprising at least one aligned pair of plaques, said aligned pair comprising first and second plaques disposed adjacent to one another on said interior plastic liner, with said first plaque having an edge portion of said substantially rectangular planar surface adjacent to an edge portion of said second plaque, and said first and second plaques being separated from one another by a channel disposed between said adjacent edge portions of said aligned pair of plaques.

5. The bowing reduction means of claim 4 wherein said channel comprises a surface coplanar with said interior plastic liner surface.

6. The bowing reduction means of claim 5 comprising a plurality of aligned pairs of plaques, each of said aligned pairs comprising a channel disposed between said first and second plaques in said aligned pair, wherein the channels of each of said plurality of aligned pairs are in alignment along said interior plastic liner.

7. An improved refrigerator cabinet structure including first and second vertical sidewalls and an interior cabinet divider wall, where each of said wall structures is formed of bonded together layers comprising a planar layer of interior plastic liner, an opposed planar layer, and an intermediate layer of insulating foam disposed between said interior plastic liner and said opposed layer, wherein said improved refrigerator cabinet includes means to reduce thermally-induced bowing of said walls, said bow-reduction means comprising:

at least one plaque formed in said interior plastic liner, said plaque comprising a substantially rectangular planar surface parallel to the plane of said interior plastic liner and offset therefrom by a predetermined distance in the direction of said intermediate foam layer; and

edge portions defining the boundaries of said substantially rectangular planar surface and extending between the planar surface of said plaque and the plane of said interior plastic layer, said edge portions providing:

expansion joints between the plane of said interior plastic layer and the plane of said substantially rectangular planar surface such that said edge portions are capable of flexure to absorb thermally-induced contraction and expansion of the interior plastic liner surface, and

beam elements on said interior plastic layer preventing bowing of said interior plastic layer; said intermediate foam insulating layer closely embracing said edge portions.

8. The refrigerator cabinet of claim 7 wherein said opposed planar layer of said cabinet wall is a layer of plastic liner material on said interior cabinet divider wall.

9. The refrigerator cabinet of claim 7 wherein said planar surfaces of said plaques are offset from the plane of said interior plastic liner by between 0.0625 and 0.25 inches.

10. The refrigerator cabinet of claim 7 wherein said opposed planar layer of said cabinet wall is an exterior steel shell of said refrigerator cabinet.

11. The refrigerator cabinet of claim 7 comprising at least one horizontally aligned pair of plaques, with said aligned pair comprising first and second plaques disposed adjacent to one another on said interior plastic liner, with said first plaque in said aligned pair having a

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vertical edge portion adjacent to a vertical edge portion of said second plaque in said horizontally aligned pair, and said first and second plaques being separated from one another by a vertical channel disposed between said adjacent vertical edges, with said channel having a surface coplanar with the surface of said interior plastic liner.

12. The refrigerator cabinet of claim 11 where said channel has a surface coplanar with the plane of said interior plastic liner.

13. The refrigerator cabinet of claim 11 comprising a plurality of horizontally aligned pairs of plaques, wherein said individual horizontally aligned pairs of plaques are vertically spaced along the surface of said interior plastic liner.

14. The refrigerator cabinet of claim 13 wherein each of said horizontally aligned pairs includes a vertical channel disposed between said individual plaques in said horizontally aligned pair, wherein the individual vertical channels of each of said plurality of horizontally aligned pairs are vertically aligned along said interior plastic liner.

15. An improved cabinet structure for a side-by-side domestic refrigerator appliance, wherein said cabinet includes first and second vertical outer sidewalls, each of said outer sidewalls formed of bonded together layers comprising a substantially planar metal shell facing the exterior of said cabinet, a substantially planar plastic liner facing the interior of said cabinet, an intermediate layer of insulating foam between said metal shell and said plastic liner, and a vertical compartment separator wall interposed between said first and second outer sidewalls for dividing the interior space of said cabinet into a frozen food compartment and a fresh food compartment, where said separator wall is formed from first and second spaced apart planar layers of plastic liner, with the first of said layers of plastic liner facing the interior of said fresh food compartment, and the second of said layers of plastic liner facing the interior of said frozen food compartment, and an intermediate layer of insulating foam between said first and second layers of plastic liner of said separator wall, wherein said improved side-by-side refrigerator cabinet includes means to reduce thermally-induced cabinet bowing of said sidewalls and said separator wall, said bow-reduction means comprising:

at least one plaque formation on said substantially planar plastic liner, said plaque formation comprising at least one substantially planar rectangular surface formed integrally with said interior plastic liner and offset therefrom in the direction of said foam by a predetermined distance, each of said rectangular surfaces further comprising two vertical edge portions and two horizontal edge portions defining the boundary of said rectangular plaque and extending between the planar surface of said plaque and the surface of said plastic interior liner, said edge portions providing:

expansion joints between the plane of said interior plastic layer and the plane of said substantially rectangular planar surface such that said edge portions are capable of flexure to absorb thermally-induced contraction and expansion of the interior plastic liner surface, and

beam elements on said interior plastic layer preventing bowing of said interior plastic layer; said intermediate foam insulating layer closely embracing said edge portions.

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16. The refrigerator cabinet of claim 15 wherein said rectangular planar surfaces of said plaques are offset from the plane of said inner plastic liner by 0.125 inches.

17. The refrigerator cabinet structure of claim 15 wherein said plaque formation comprises a single rectangular plaque, and a plurality of said rectangular plaques are spaced vertically along said interior plastic liner.

18. The refrigerator cabinet structure of claim 15 wherein each of said plaque formations comprises a horizontally aligned pair of plaques, with said aligned pair comprising first and second plaques disposed adjacent to one another on said interior plastic liner, with said first plaque in said aligned pair having a vertical edge portion adjacent to a vertical edge portion of said second plaque in said horizontally aligned pair, and said first and second plaques being separated from one another by a vertical channel disposed between said adjacent vertical edges, with said channel having a surface coplanar with the surface of said interior plastic liner.

19. The refrigerator cabinet of claim 18 comprising a plurality of horizontally aligned pairs of plaques, wherein said individual horizontally aligned pairs of plaques are vertically spaced along the surface of said interior plastic liner.

20. The refrigerator cabinet of claim 19 wherein each of said horizontally aligned pairs includes a vertical channel disposed between said individual plaques in said horizontally aligned pair, wherein the individual vertical channels of each of said plurality of horizontally aligned pairs are vertically aligned along said interior plastic liner.

21. The refrigerator cabinet of claim 15 wherein said rectangular planar surfaces of said plaques are offset from the plane of said inner plastic liner by between 0.0625 and 0.25 inches.

22. An improved refrigerator cabinet structure including first and second vertical sidewalls, each of said sidewalls formed of bonded together layers comprising a substantially planar exterior metal shell, a substantially planar interior plastic liner having a general plane, and an intermediate layer of insulating foam, wherein said improved refrigerator cabinet includes means to reduce thermally-induced cabinet bowing, said bow-reduction means comprising:

an array of substantially identical adjacent multiplanar formations of said plastic liner, each of said multiplanar formations comprising:

a predetermined number of adjacent intersecting planar surfaces angularly offset from said general plane of said plastic liner in the direction of said foam, each planar surface comprising at least three linear edge portions including:

a single linear base edge which intersects said general plane along a line segment, and first and second linear side edges, wherein each of said linear side edges defines the intersection of said planar surface with an adjacent planar surface along a line segment; and

wherein a plurality of said multiplanar formations are formed on said plastic liner surface and are disposed adjacent one another in an array such that at least one base edge of each of said multiplanar formations intersect with a base edge of an adjacent multiplanar formation along a line segment; and each of said edge portions providing:

expansion joints between the plane of said interior plastic layer and the plane of said substantially

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rectangular planar surface such that said edge portions are capable of flexure to absorb thermally-induced contraction and expansion of the interior plastic liner surface, and

beam elements of said interior plastic layer preventing bowing of said interior plastic layer; said intermediate foam insulating layer closely embracing said edge portions.

23. The improved refrigerator cabinet structure of claim 22 wherein each of said substantially identical multiplanar formations comprises six adjacent planar surfaces, wherein each of said planar surfaces is triangular in shape, and all of said planar surfaces in said multiplanar formation intersect with one another at a single point.

24. The improved refrigerator cabinet structure of claim 22 wherein two of said planar surfaces in each of

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said substantially identical multiplanar formation comprise four linear edge portions, including a remote edge, wherein said remote edges of both of said four-edged planar surfaces intersect along a line segment.

25. The improved refrigerator cabinet structure of claim 24 wherein each of said substantially identical multiplanar formations comprises six adjacent planar surfaces, wherein

four of said planar surfaces are triangular in shape, and comprise three edges, including a base edge and a first and second side edges, and

two of said planar surfaces are trapezoidal in shape, and comprise four edges, including a base edge, first and second side edges, and a remote edge, and wherein said remote edges of both of said trapezoidal planar surfaces intersect along a line segment.

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EXHIBIT 11



US005269154A

United States Patent [19]

Schmidt

[11] Patent Number: 5,269,154

[45] Date of Patent: Dec. 14, 1993

[54] HEATED ICE DOOR FOR DISPENSER

[75] Inventor: Christopher G. Schmidt, Knight Township, Vanderburgh County, Ind.

[73] Assignee: Whirlpool Corporation, Benton Harbor, Mich.

[21] Appl. No.: 914,400

[22] Filed: Jul. 17, 1992

[51] Int. Cl.⁵ F25D 21/06

[52] U.S. Cl. 62/275; 62/344;

62/389

[58] Field of Search 62/272, 273, 275, 80, 62/377, 344, 389

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Primary Examiner—Henry A. Bennet

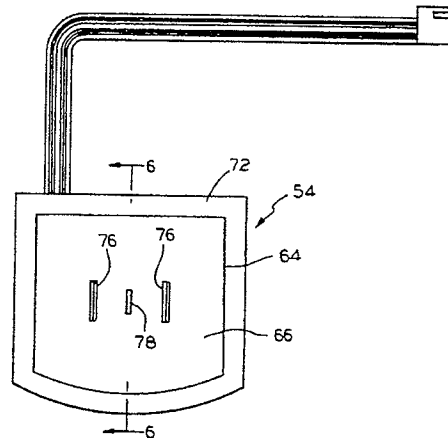
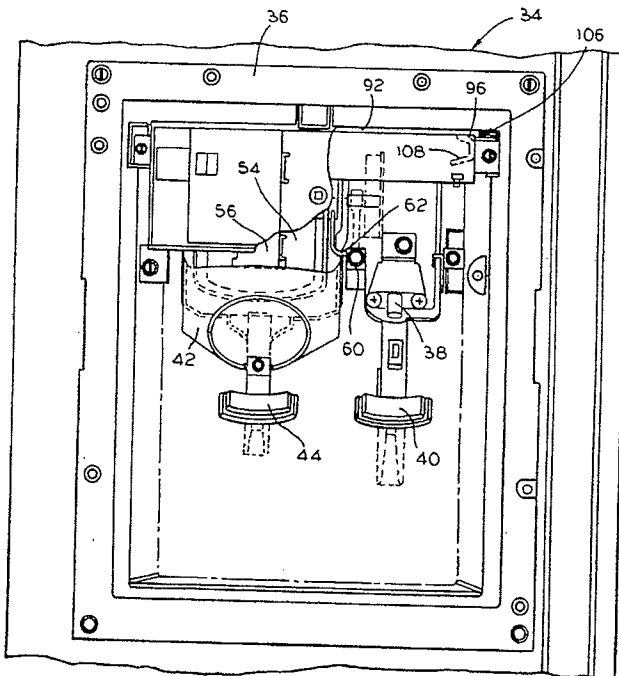
Assistant Examiner—William C. Doerrler

Attorney, Agent, or Firm—Thomas J. Roth; Thomas E. Turcotte; Stephen D. Krefman

[57] ABSTRACT

A closure is shown for use with an ice dispensing apparatus having an ice chute operatively associated with a discharge opening. The closure includes a door case having a front wall of a size and shape corresponding to the opening and a rearwardly turned perimeter wall connected to the front wall and having an outwardly turned flange. An insulation core is disposed within the perimeter wall rearwardly of the front wall. A gasket engages the opening incident to the closure being in the closed position. A rear wall is provided for substantially covering the opening incident to the closure being in the closed position. A resistance heater is positioned in the door case between the front wall and the insulation to prevent sweating of the closure.

11 Claims, 4 Drawing Sheets



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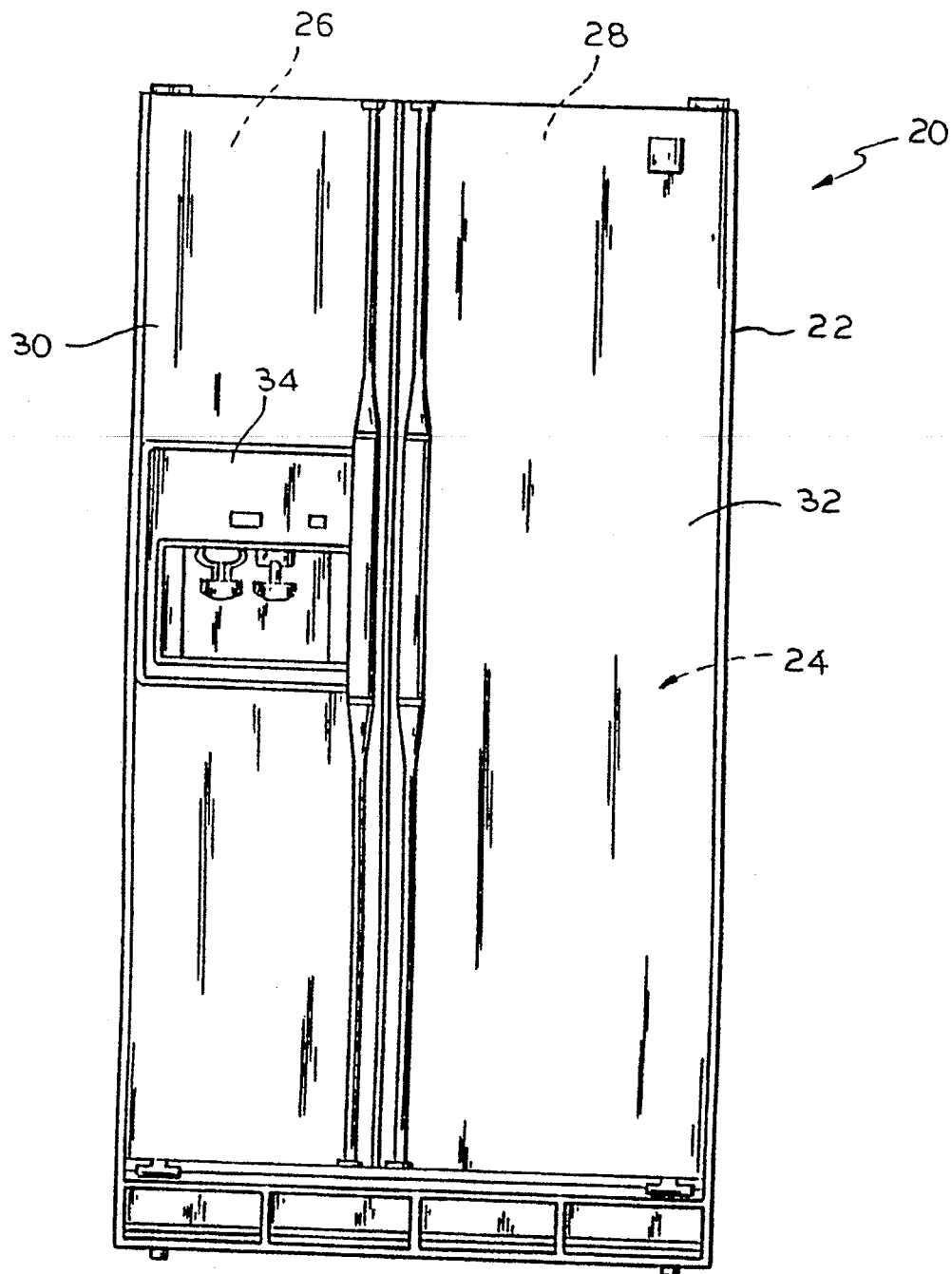


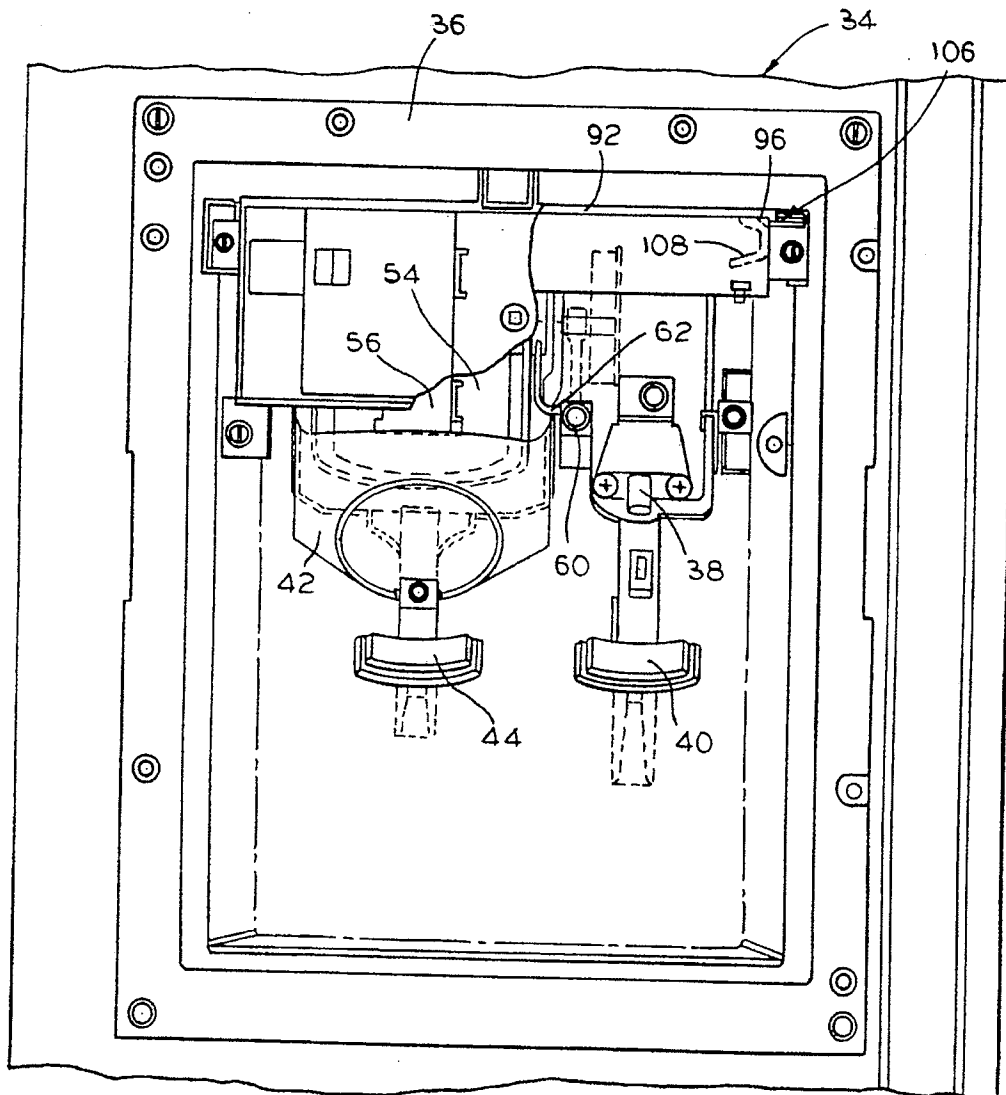
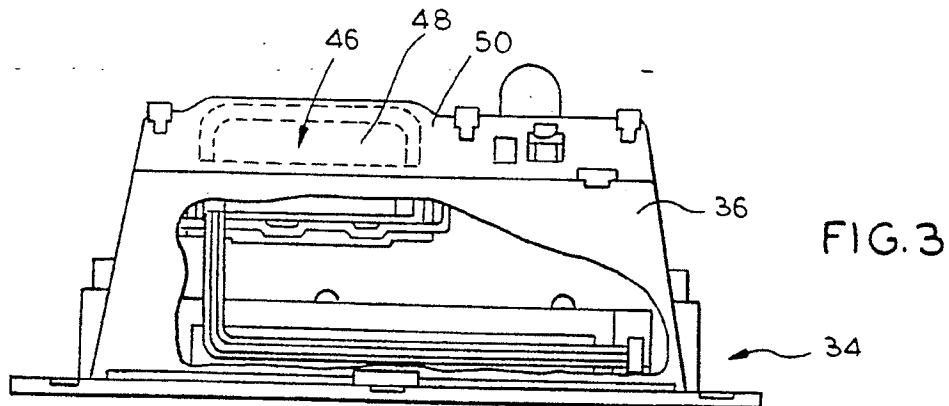
FIG. 1

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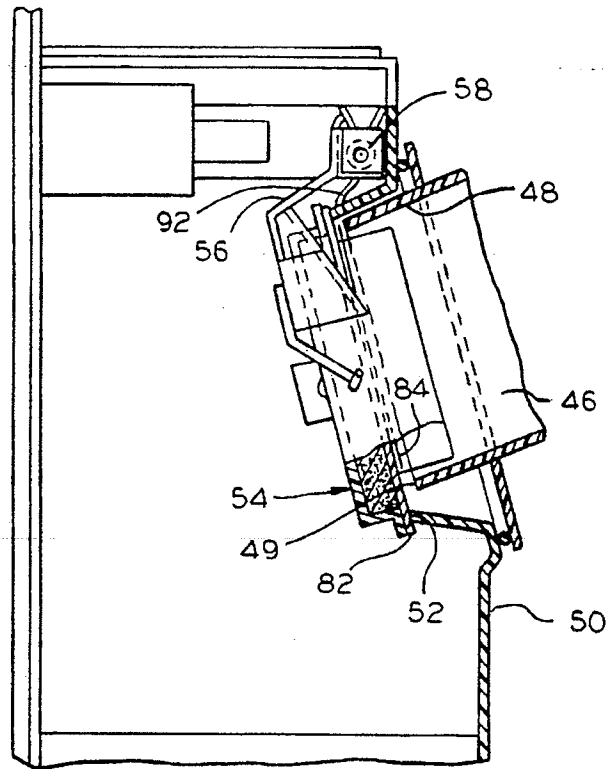


FIG. 4

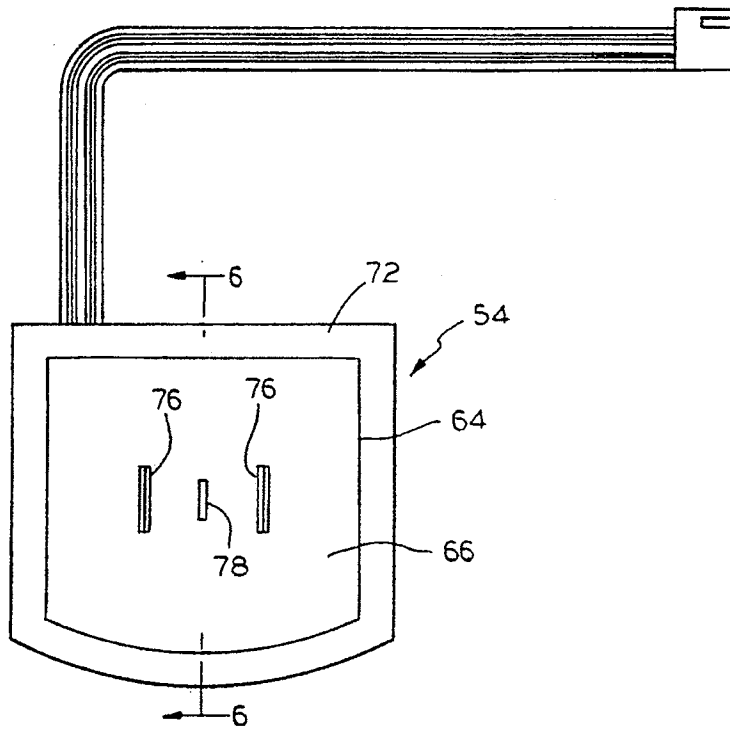


FIG. 5

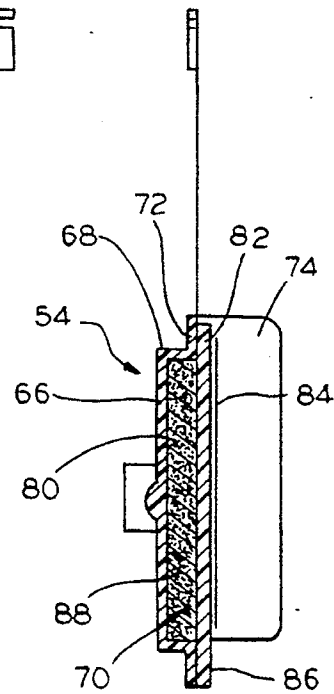


FIG. 6

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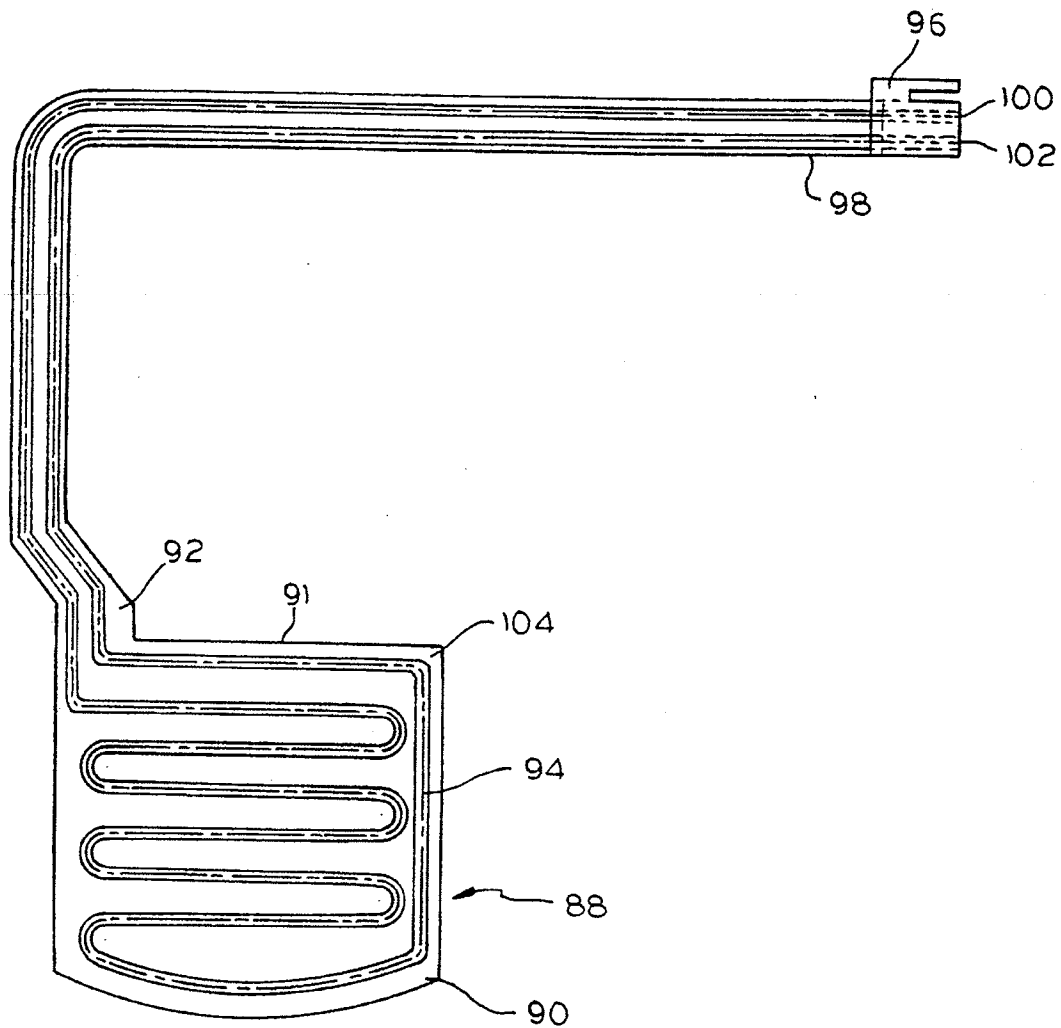


FIG. 7

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HEATED ICE DOOR FOR DISPENSER

FIELD OF THE INVENTION

This invention relates to an ice dispensing apparatus and, more particularly, to an improved closure therefor.

BACKGROUND OF THE INVENTION

In one form of an ice making apparatus, an automatic apparatus is provided for forming ice bodies and periodically delivering the formed ice bodies into a subjacent container maintained within a freezer space of a refrigeration apparatus cabinet. In one conventional form, the ice bodies are removed from the container by a user grasping the ice bodies through an open top of the container and removing the desired quantity.

In another form of a refrigeration apparatus, a through-the-door ice dispenser is provided for automatically delivering a desired quantity of formed ice bodies from the container into a suitable receptacle, such as a glass or pitcher. Such an apparatus includes a conveying means for conveying ice bodies stored in the container to a discharge chute in the door. One example of such an automatic ice body dispenser is shown in Buchser U.S. patent application No. 549,651, filed Jan. 2, 1990, which is owned by the assignee of the present invention. As disclosed therein, the ice bodies are delivered from the container to a transfer mechanism by means of an auger which is rotated by a motor at the rear end of the auger. The forward end of the auger is connected to the transfer mechanism which transfers the ice bodies seriatim to the subjacent transfer chute leading to the dispensing area.

A typical conventional through-the-door ice dispenser includes a front opening in the ice chute through which ice pieces are delivered in a dispensing operation. The ice pieces may comprise the fully formed ice bodies, or crushed ice. Such an ice dispensing apparatus is shown in Buchser et al., U.S. patent application No. 522,901, which is owned by the assignee of the present invention, and which comprises a closure mounted frontwardly of the opening and being biased to a closed position wherein the closure effectively blocks the opening. An actuator is mounted adjacent the closure for moving the closure to an open position to permit free delivery of ice pieces through the opening as an incident of the actuator being moved from a released position to an actuated position.

Such a closure comprises an insulated well having an outer gasket for sealing engagement with the discharge chute. With such an ice dispensing apparatus, it is possible that external sweating, i.e., moisture or condensation, will appear in the ice dispenser area under high temperature or humidity conditions. This sweating results from the relatively low temperature inside the chute and the ambient conditions to which the exterior of the closure is exposed.

The present invention is directed to overcoming one or more of the problems as set forth above.

SUMMARY OF THE INVENTION

There is disclosed herein, in accordance with the present invention, an ice dispenser closure provided with a heater to prevent external condensation.

Broadly, there is disclosed herein an ice dispensing apparatus having an ice chute operatively associated with a discharge opening through which ice bodies are delivered in a dispensing operation. An improvement

therein comprises a closure of a size larger than the discharge opening. Means are provided for mounting the closure frontwardly adjacent the opening and including means for moving the closure between an open position to permit free delivery of ice pieces through the opening and a closed position wherein the closure effectively blocks the opening. A heating means is operatively associated with the closure for heating the closure to prevent sweating thereon.

It is a feature of the invention that a heater is provided internally to the closure.

It is another feature of the invention that the heating means is a resistance heater.

It is still another feature of the invention that the heating means is connected to an external power source, and including a flexible conductor extending between the closure and the source of power.

It is another feature of the invention that the closure includes a door case having a front well having an outwardly turned perimeter flange connected to a rear wall for engaging the opening, and the heating means is disposed between the front well and the rear wall.

There is disclosed herein in accordance with a further aspect of the invention an improvement in an ice dispensing apparatus having an ice chute comprising a generally tubular-like wall portion operatively associated with a discharge opening through which ice pieces are delivered in a dispensing operation. The improvement comprises an ice chute closure including a door case having a front well of a size and shape corresponding to the discharge opening, the well being connected to an outwardly turned perimeter flange. The flange supports a gasket. Means are provided for mounting the closure frontwardly of the opening and being biased to a closed position wherein the closure effectively blocks the opening with the gasket sealing against the wall portion and the baffles being disposed outwardly of the wall portion. An actuator is mounted adjacent the closure and includes means for moving the closure to an open position to permit free delivery of ice pieces through the opening as an incident of the actuator being moved from a released position to an actuated position. A heating means is operatively associated with the ice chute closure for heating said closure to prevent sweating thereon.

More specifically, there is disclosed herein a closure for use with an ice dispensing apparatus having an ice chute operatively associated with a discharge opening. The closure includes a door case having a front wall of a size and shape corresponding to the discharge opening, a rearwardly turned perimeter wall connected to the front wall and having an outwardly turned flange. An insulation core is disposed within the perimeter wall rearwardly of the front wall. A gasket engages the opening incident to the closure being in the closed position. A rear wall is provided for substantially covering the chute opening incident to the closure being in the closed position. Means are provided for adhering the gasket and the rear wall in assembled relation with the flange. A resistance heater is enclosed in the door case to prevent external condensation on the closure.

Further features and advantages of the invention will readily be apparent from the specification and from the drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation view of a refrigeration apparatus including an ice dispenser closure according to the invention;

FIG. 2 is a front elevation, partially cutaway view of a through-the-door ice dispensing housing of FIG. 1 with a cover plate removed;

FIG. 3 is a top plan, partially cutaway view of the housing of FIG. 2;

FIG. 4 is a partial sectional view, with parts removed for clarity, of FIG. 2 specifically illustrating a closure in the closed position;

FIG. 5 is a front elevation view of the closure of FIG. 2;

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5; and

FIG. 7 is an elevation view of a resistance heater included in the closure of FIG. 5.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. 1, a refrigeration apparatus 20, comprising a side-by-side refrigerator/freezer, includes a cabinet 22 having a storage space 24. Particularly, the storage space 24 comprises a below-freezing, or freezer, compartment 26, and an above-freezing, or fresh food, refrigerated compartment 28. Access to the compartments 26 and 28 is had through respective freezer and refrigerator doors 30 and 32 hingedly mounted to the cabinet 22, as is well known.

The freezer door 30 is provided with a through-the-door ice and water dispenser 34. The dispenser 34 is contained within a housing 36, see FIGS. 2 and 3, suitably mounted in the freezer door 30. The dispenser 34 includes a water spigot 38 through which water is automatically transferred to a receptacle position therebelow actuating a water dispenser lever 40, and an ice passage 42 through which ice pieces may be automatically transferred upon actuation of an ice dispenser lever 44. In the illustrated embodiment, the ice pieces may be fully formed ice bodies or crushed ice.

Although not shown, the freezer compartment 26 houses a conventional ice making apparatus which delivers ice pieces to a downwardly, forwardly inclined delivery chute 46 in the door 30, see FIG. 4. Particularly, the chute 46 comprises a generally tubular-like wall portion 48 defining a front opening 49 which opens into a discharge opening 52 of a rear wall 50 of the dispenser housing 36 through which ice pieces are delivered in a dispensing operation. The discharge opening 52 is configured to be generally rectangular, except that the bottom edge thereof is curved to facilitate transfer of ice pieces, as is well known.

A closure 54 is mounted frontwardly of the opening 52. Specifically, a mounting structure 56 is pivotally mounted to the housing 36 as at a pivot link 58, and the mounting structure 56 biases the closure 54 to a closed position, illustrated in FIG. 4, effectively blocking the opening 52. As illustrated generally in FIG. 2, the ice dispenser lever 44 is mounted in the housing 36 adjacent the closure 54 and includes an actuator arm 60 for engaging a connecting rod 62 extending sidewardly from the mounting structure 56. As such, movement of the dispenser lever 44 from a released position to an actuated position causes the closure 54 to move to the open position, not shown, to permit free delivery of ice pieces through the opening 52.

The mounting structure 56 and its operation as disclosed herein are for illustration only. For a more complete understanding relative to the operation of the same, reference may be had to Marks U.S. Pat. No. 4,089,436, owned by the assignee hereof. In fact, the particular mounting structure and actuating mechanism may take many known forms and the embodiment disclosed herein is merely an illustrative of one such known form.

In accordance with the invention, the closure 54 prevents external condensation from collecting thereon.

With reference to FIGS. 5 and 6, the closure 54 is illustrated in detail. The closure 54 includes a door case 64 having a front wall 66 of a size and shape corresponding to the discharge opening 52. A rearwardly turned perimeter wall 68 is connected to the front wall 66 to provide a well 70. A perimeter flange 72 is connected to and extends outwardly from the perimeter wall 68. A pair of baffle walls 74, one of which is shown, are connected to and extend rearwardly from opposite sides of the flange 72. A pair of locking tabs 76 extend frontwardly from the front wall 66 and are used for mounting the closure 54 to the locking structure 56, as disclosed in FIG. 4. A protrusion 78, also on the front wall 66 between the locking tabs 76, rides on the locking structure 56 to allow for limited movement between the closure 54 and mounting structure 56 to insure a proper seal when the closure 54 is in the closed position.

In the illustrated embodiment, the door case 64 is of integral, molded construction, and may be of, for example, A.B.S flame retardant plastic.

In order to minimize heat transfer between the freezer compartment 26 and the outside, the well 70 is filled with a core 80 of insulation. The core 80 may comprise, for example, closed-cell polyethylene foam. The core 80 is flush mounted with the flange 72 and supports a foam pad 82. Particularly, the foam pad 82 is secured using a suitable adhesive to both the flange 72 and the core 80. The foam pad 82 may be, for example, closed-cell polyethylene foam. The pad 82 is slightly larger than the discharge opening 52 so that when the closure 54 is in the closed position, see FIG. 4, the outer edge of the pad 82 engages the same.

An impact shield 84 is secured to the rear surface of the pad 82. Particularly, the impact shield 84 may comprise, for example, a mylar polyester clear film. The shield 84 may be sealed using pressure sensitive adhesive to the pad 82. The impact shield 84 is of a size corresponding to that of the gasket pad 82, but is of a slightly smaller size so that a peripheral, outer edge gasket portion 86 of the pad 82 is exposed.

Thus, when the closure 54 is in a closed position, as illustrated in FIG. 4, the gasket outer edge portion 86 engages the outer edge of the housing 50 at the opening 52 to provide a seal and prevent flow of air between the freezer compartment and ambient. Further, the impact shield 84 minimizes the amount of ice which comes into direct contact with the pad 82 in order to prevent freeze up thereof which would diminish the sealing capability of the pad 82.

When the closure 54 is in the closed position, see FIG. 3, the baffle walls 74 are disposed outwardly of the ice chute wall portion 48. When the closure 54 is moved to the open position, a free delivery of ice pieces is permitted through the opening 52. At the same time, the baffle walls 74 which are positioned on opposite sides of the chute wall portion 48 direct the flow of ice pieces delivered through the opening 52.

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In order to prevent external condensation on the closure 54, a heater 88 is provided in the well 70 sandwiched between the front wall 66 and the insulation core 80.

With reference to FIG. 7, the heater 88 is illustrated in detail. The heater 88 is of laminated construction and comprises a pair of laminated plastic sheets 90. The sheets 90 have a generally rectangular main portion 91, of a size and shape corresponding to the closure front wall 66, connected at an upper corner to an elongate, generally L-shaped extending portion 92. Silkscreened between the plastic sheets 90 is a track 94 of conductive, resistance ink traced thereon in a serpentine configuration. A silver blend of significantly lower resistance is screened on the trailing portion 92, or areas in which heat is not required. A termination stabilizer 96 is secured to the trailer distal end 98 for connection of the opposite ends 100 and 102 of the track 94 to a power source.

An aluminum foil plate, indicated generally at 104, is provided on a back side of one of the plastic sheets 90. The foil layer 104 further distributes heat and isolates the heater 88 from the insulator core 80.

The plastic sheets 90 are flexible. When mounted in the closure, the connecting portion 92 extends upwardly therefrom, see FIG. 4, so as not to impede with opening and closing movement of the closure 54. The termination stabilizer 96 is then connected, as at 106, see FIG. 2, to suitable supply terminals 108 for powering the same. This provides for continuous energization of the heater trace resistance track 94.

The heater 88 mounted in the closure 54 has been found to considerably reduce external condensation with a relatively low wattage heater on the order of two watts.

Thus, there is disclosed herein, in accordance with the invention, a closure for use with an ice dispensing apparatus which includes a heater for preventing external condensation.

The disclosed embodiments of the invention are illustrative of the broad inventive concepts comprehended hereby.

I claim:

1. In an ice dispensing apparatus having an ice chute operatively associated with a discharge opening through which ice pieces are delivered in a dispensing operation, the improvement comprising:

a closure of a size larger than said discharge opening; means for mounting said closure frontwardly adjacent said opening and including means for moving said closure between an open position to permit free delivery of ice pieces through said opening and a closed position wherein said closure effectively blocks said opening; and

heating means operatively associated with said closure for heating said closure to prevent sweating thereon, said heating means comprises a laminated heater consisting of a pair of plastic sheets sandwiching a resistance heater element, said heater element comprises a track of conductive, resistance ink screened on said plastic sheets.

2. The improvement of claim 1 wherein said heating means is movable with said closure and said heating means further comprises a flexible connector for connection to a power source.

3. In an ice dispensing apparatus having an ice chute comprising a generally tubular-like wall portion operatively associated with a discharge opening through

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which ice pieces are delivered in a dispensing operation, the improvement comprising:

a closure including a door case having a front well of a size and shape corresponding to said discharge opening, said well being connected to an outwardly turned perimeter flange, said flange supporting a gasket;

heating means mounted in said door case for heating said closure to prevent sweating thereon; and

means for mounting said closure frontwardly adjacent said opening and including means for moving said closure between an open position to permit free delivery of ice pieces through said opening and a closed position wherein said closure effectively blocks said opening, said heating means comprises a laminated heater consisting of a pair of plastic sheets sandwiching a resistance heater element, said heater element comprises a track of conductive, resistance ink screened on said plastic sheets.

4. In an ice dispensing apparatus having an ice chute comprising a generally tubular-like wall portion operatively associated with a discharge opening through which ice pieces are delivered in a dispensing operation, the improvement comprising:

a closure including a door case having a front well of a size and shape corresponding to said discharge opening, said well being connected to an outwardly turned perimeter flange, said flange supporting a gasket;

heating means mounted in said door case for heating said closure to prevent sweating thereon;

means for mounting said closure frontwardly adjacent said opening and including means for moving said closure between an open position to permit free delivery of ice pieces through said opening and a closed position wherein said closure effectively blocks said opening; and

a core of insulation disposed in said well rearwardly of said heating means.

5. The improvement of claim 4 wherein said heating means comprises a foil layer on an outer surface in contact with said core of insulation.

6. A closure for use with an ice dispensing apparatus having an ice chute operatively associated with a discharge opening through which ice pieces are delivered in a dispensing operation, the closure being mounted frontwardly of the opening and being biased to a closed position wherein the closure effectively blocks the opening, and an actuator mounted adjacent the closure and including means for moving the closure to an open position to permit free delivery of ice pieces through the opening as an incident of the actuator being moved from a released position to an actuated position, the closure comprising:

a door case having a front wall of a size and shape corresponding to the discharge opening and a rearwardly turned perimeter wall connected to said front wall and having an outwardly turned flange; heating means mounted in said door case for heating said closure to prevent sweating thereon;

an insulation core disposed within said perimeter wall rearwardly of said front wall;

a gasket for engaging the ice chute incident to the closure being in the closed position;

a rear wall for substantially covering said discharge opening incident to the closure being in the closed position; and

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means adhering said gasket and said rear wall in assembled relation with said flange.

7. The closure of claim 6 wherein said heating means comprises a resistance heater.

8. The closure of claim 6 wherein said heating means is movable with said closure and said heating means further comprises a flexible connector for connection to a power source.

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9. The closure of claim 6 wherein said heating means comprises a laminated heater consisting of a pair of plastic sheets sandwiching a resistance heater element.

10. The closure of claim 9 wherein said heater element comprises a track of conductive, resistance ink screened on said plastic sheets.

11. The closure of claim 6 wherein said gasket comprises a pad having its outer edges secured to said flange and said rear wall comprises an impact shield secured to a rear surface of said pad wherein only a peripheral edge portion of said gasket is exposed.

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EXHIBIT 12



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(12) **United States Patent**
Leimkuehler et al.

(10) Patent No.: **US 6,997,526 B2**
(45) Date of Patent: **Feb. 14, 2006**

(54) **REFRIGERATOR DOOR STORAGE SYSTEMS**

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(73) Assignee: **Maytag Corporation**, Newton, IA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/314,703**

(22) Filed: **Dec. 9, 2002**

(65) **Prior Publication Data**

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(51) Int. Cl. **A47B 96/04** (2006.01)

(52) U.S. Cl. **312/321.5; 312/405.1**

(58) Field of Classification Search **312/321.5, 312/404, 405.1, 408**

See application file for complete search history.

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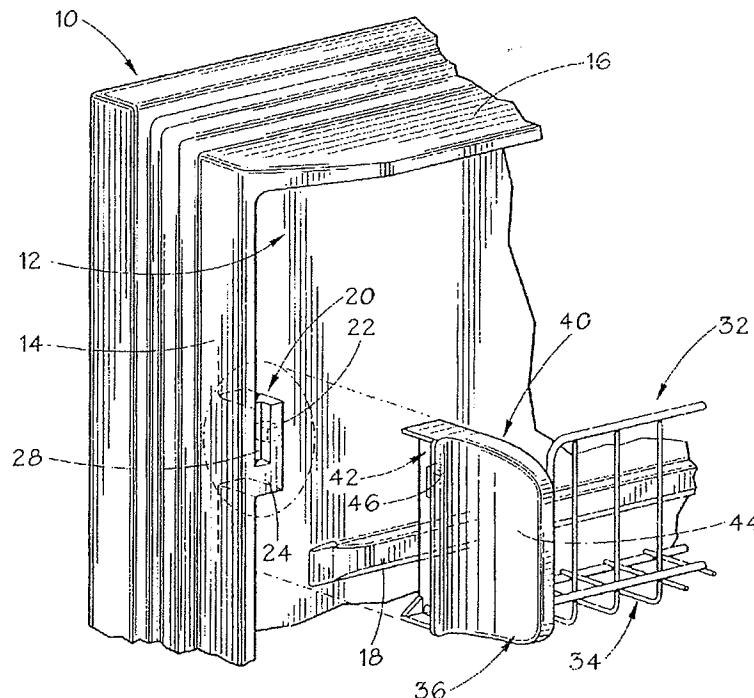
Primary Examiner—Peter R. Brown

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(57) **ABSTRACT**

Devices and methods for reversibly securing a shelf trim piece or the like to a refrigerator door panel. The shelf securing arrangement does not require holes to be disposed in the door panel. A positive snap-lock securement is provided.

74 Claims, 4 Drawing Sheets

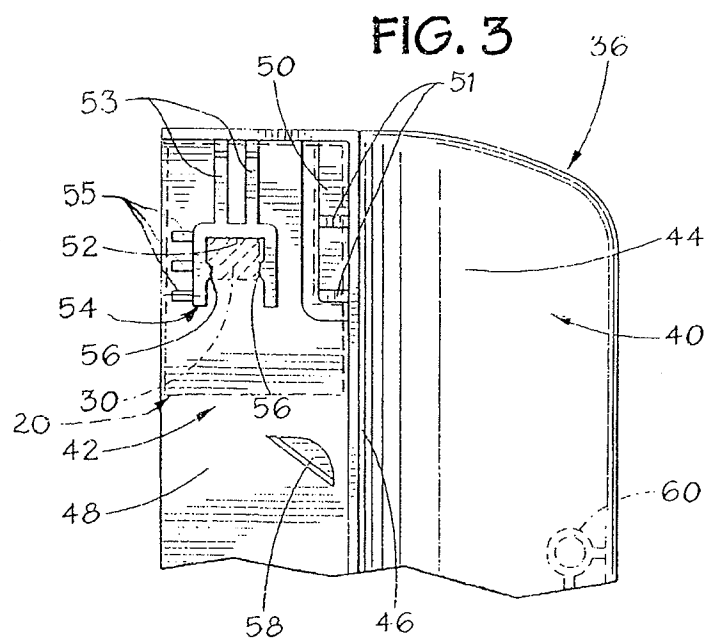
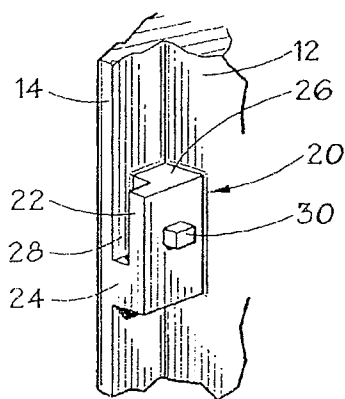
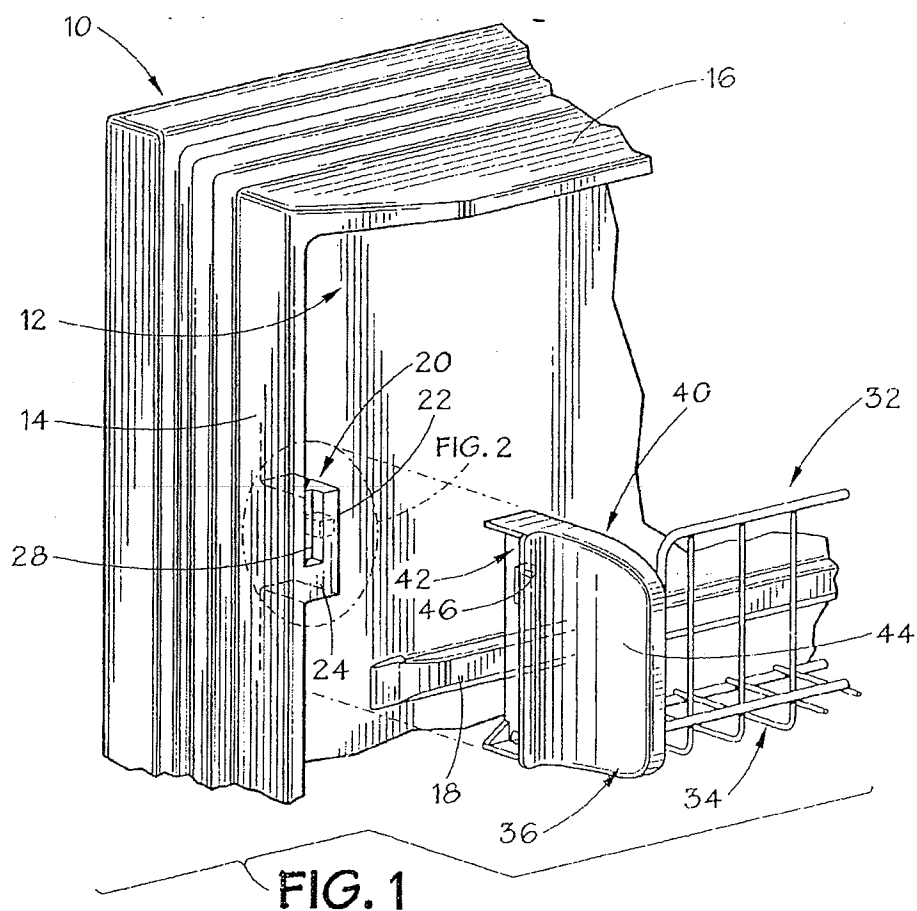


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FIG. 4

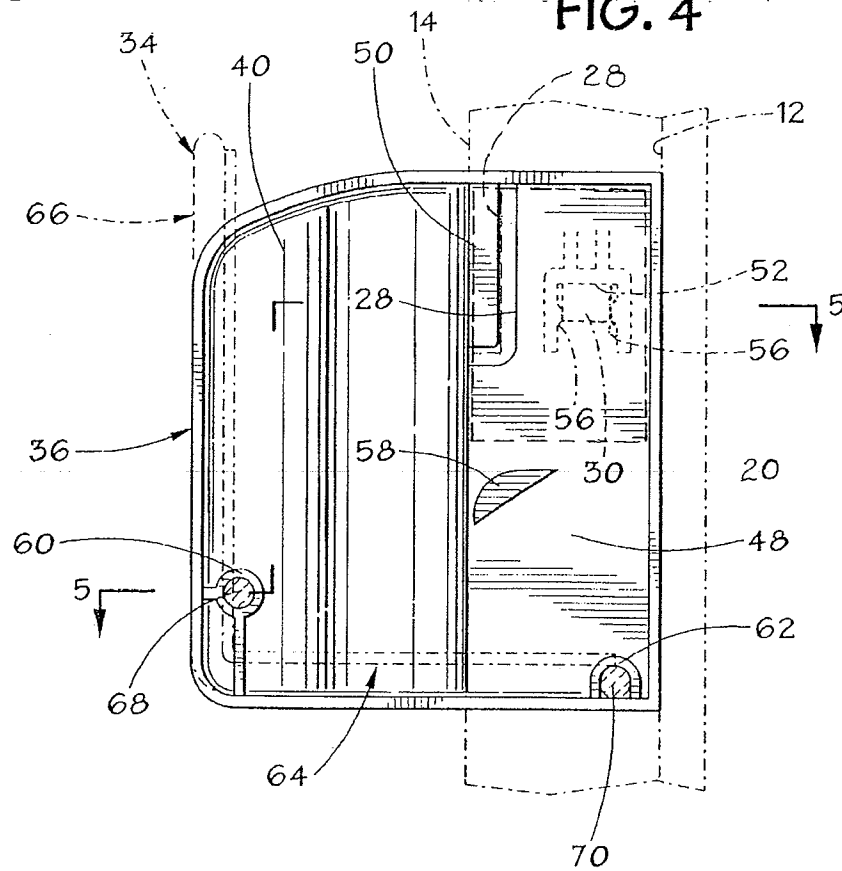


FIG. 6

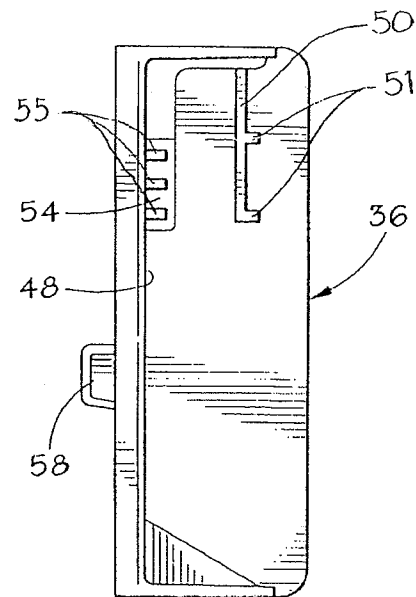
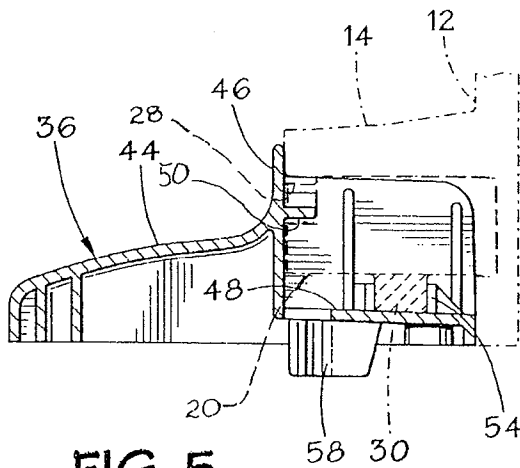


FIG. 5

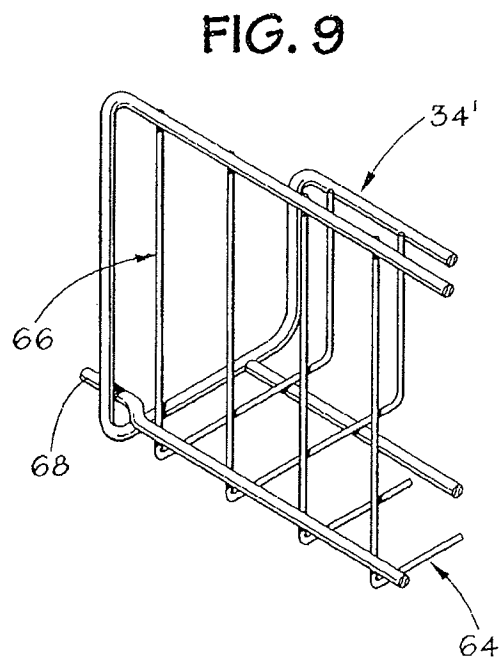
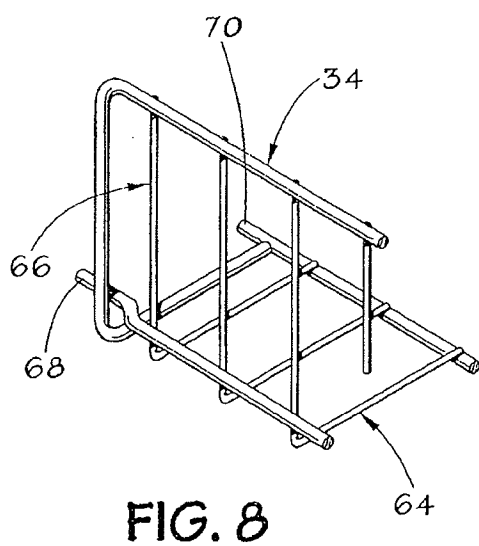
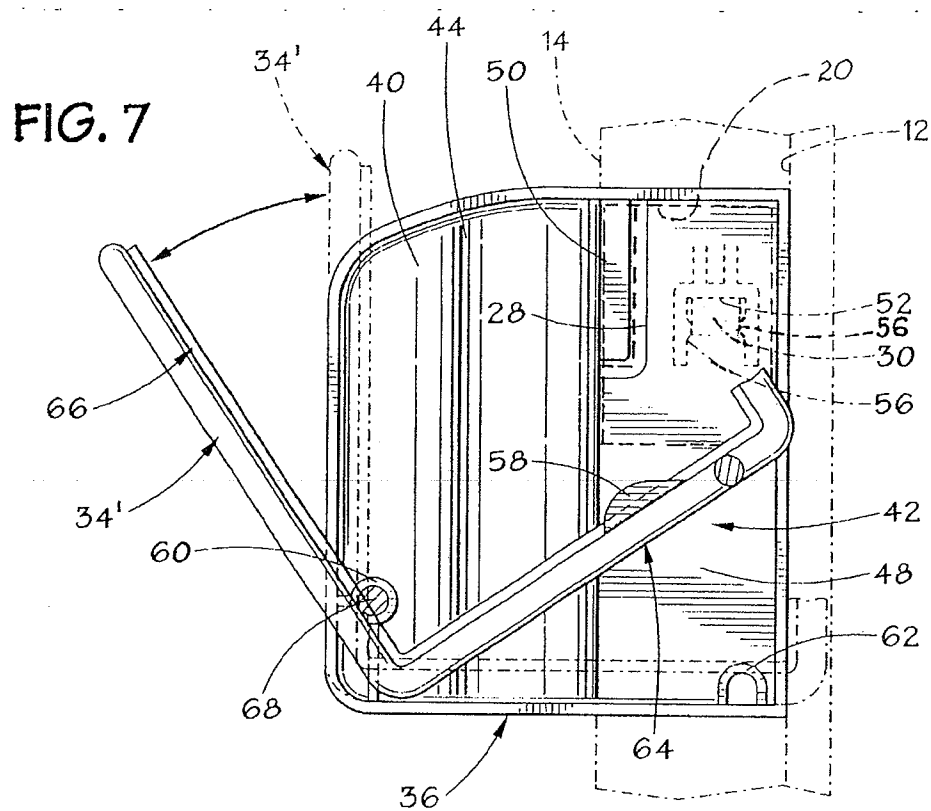


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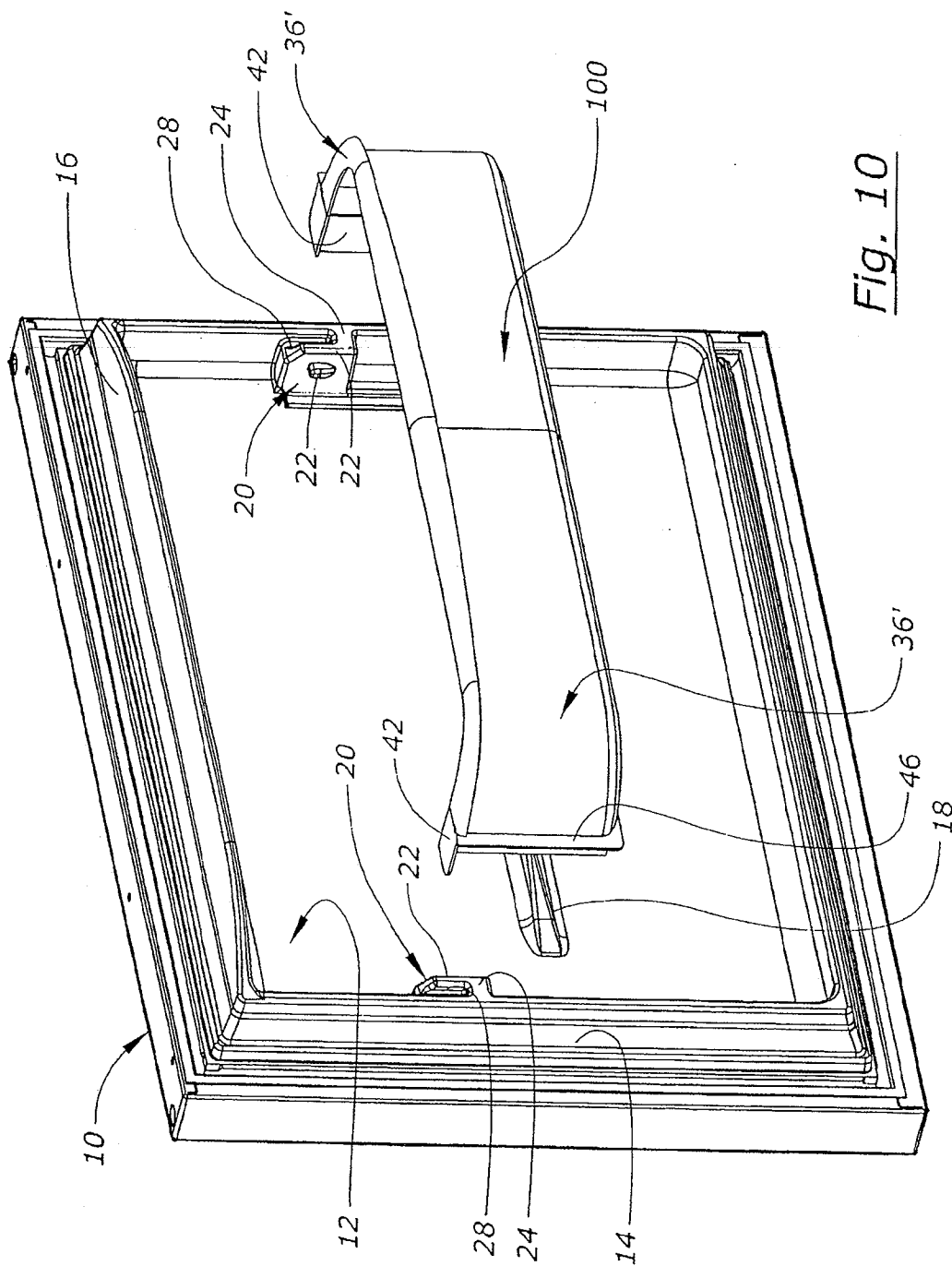


Fig. 10

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REFRIGERATOR DOOR STORAGE SYSTEMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to storage systems for refrigerator doors and, in particular aspects, to devices and methods for affixing panels, shelves, retainers, and the like to an interior portion of a refrigerator door. In other particular aspects, the invention relates to an outwardly tiltable shelf or basket assembly for use in a refrigerator door.

2. Description of the Related Art

Contemporary refrigerators have doors that are equipped with shelves and storage areas where food items may be placed and conveniently accessed. Although interior door storage systems have been used for a long time, there remains a need for acceptable arrangements for reversibly securing associated components to the door panel. These components include shelves, baskets and trim.

Storage systems are known that require slots or apertures to be placed in the door panel. Complimentary-shaped pins on the storage shelf slide into the slots. Such a system is described in U.S. Pat. No. 5,042,398 issued to Lau, et al. Another example is found in U.S. Pat. No. 5,160,191 issued to Holland, et al. This type of securing arrangement is undesirable since the slots form a point of weakness in the door panel. Over time, cracks can develop around the slots leading to an eventual failure. Further, an opening through the door panel is also undesirable since moisture can enter the opening and can lead to mold and fungus growth within the door resulting in unpleasant smells and generally unhealthy conditions. Also, with a foam-in-place door construction, any opening would provide a leakage path.

An alternative shelf support system is described in U.S. Pat. No. 5,322,366 issued to Revlett, et al. A shelf trim piece is reversibly secured to an interior refrigerator door panel using a snap-fit connection. The snap-fit connection is formed between sidewards extending projections located on interior door dikes and the end caps of the trim piece. Each of the end caps has a deformable end wall with a ramped portion and an opening disposed therein. The trim piece is attached to the door panel by aligning the end caps with the door dikes and then sliding the trim piece horizontally toward the door panel. As the ramped portions of the end walls contact the projections on the dikes, the end walls are temporarily deformed to move the openings in the end walls over the projections in a snap-fit manner. To remove the trim piece, one must pull the end wall sideways and then slide the trim piece horizontally away from the door panel.

This type of arrangement is problematic. The use of a deformable end wall together with an opening presents a structural weak point in the trim piece. The end wall may be easily broken off, particularly during the operation of removing the trim piece from the door liner. This is especially true in reduced wall thickness liners that are now prevalent and necessary to form a channel for mounting a dart-type door gasket.

U.S. Pat. No. 5,370,455 issued to Sedovic, et al. describes a refrigerator door storage assembly wherein a shelf module contains a pair of generally L-shaped slots on either lateral side. The liner of the refrigerator door has bosses that nest within the slots when the shelf module is placed onto the door liner. This arrangement is also not optimal. The nesting arrangement, while permitting a user to easily remove the module, is not secure enough in practice. Significant jolts to

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the door may cause the module to become dislodged, and children can too easily remove the modules.

Also, the process of removing a large object, such as a carton of milk, from below the module, may inadvertently release the module from the door. Undesirable lateral movement of the shelf module is also possible.

Some shelf, basket, or retainer connection arrangements utilize structure which extends forwardly of the door liner dikes. This can present issues and problems when trying to design a door liner for use with different types of doors (e.g. hinged, pullout), or different types of baskets, shelves, retainers, etc., or for different models of refrigerators (refrigerators or freezers). It can be desirable to avoid or minimize such forward extensions. Doing so can be advantageous to provide clearance to parts and minimize space taken for retaining geometry. It can also facilitate interchangeability for different styles and models of refrigerators, thus reducing capital expenses in design and manufacturing. Similarly, it can be desirable to avoid or minimize structure which extends inwardly from the edges of the door liner or the door liner dikes.

An improvement that addresses the problems of the prior art would be desirable.

It is within the context of the problems and concerns previously described that a need for improvement in the art exists. There is a need for a system that can be used to support from the door liner both a structure such as a retaining member, shelf, or basket, and the weight of items placed on the same, and which provides sufficient strength and is durable. Further needs exist regarding a system that can be locked in place, but is easy to remove, yet occupies a minimum amount of space.

SUMMARY OF THE INVENTION

Devices and methods are described for reversibly securing a shelf trim piece or the like to a refrigerator door panel. The shelf securing arrangement does not require holes to be disposed in the door panel. A positive snap-lock securement can be provided. In described embodiments, a flush-mount flange member is provided that adjoins the door dike to provide an indication of proper horizontal alignment as well as an aesthetically pleasing appearance.

In a preferred embodiment, a tilt-out shelf or basket arrangement is reversibly secured to the interior of a refrigerator door. The shelf or basket has a pair of end caps that are reversibly secured to dikes on the door panel. The vertical dikes of the door panel have specially-shaped mounting portions that can include laterally projecting bosses. The mounting portions can be configured to be formed in the door liner in relatively low profile, both relative to forward or inward (medial) directions from the dike. The door panel also can have a horizontally disposed support that can adjoin the lower edge of the basket or shelf.

In a preferred embodiment, each end cap has a boss contacting portion that includes a vertically oriented, generally U-shaped channel that is open at its lower end. The channel is shaped and sized to be complimentary to the boss and contains a raised bump so that when the boss is inserted into the channel a positive snap-lock securement is achieved. The end caps may be removed from the door panel by reversing this process.

A number of alternative basket, shelf, or other retainer assemblies are described that may be used with the end cap securing arrangement of the present invention. In one instance, a wire holding area is fixedly secured between the end caps while, in another, a wire holding area may be

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forwardly and rearwardly tilted with respect to the end caps. In a further arrangement, a plastic molded shelf having the end cap support geometry molded in place, can be used.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric, exploded view of a portion of the interior side of a refrigerator freezer door with a basket having a removably affixable end cap constructed in accordance with the present invention.

FIG. 2 depicts a portion of one of the door dikes to which an end cap is reversibly affixed.

FIG. 3 is an exterior side view of an exemplary end cap and in ghost lines illustrating a snap-fit connection with part of the mounting structure on the door liner.

FIG. 4 is an interior side view, partially in phantom, of a fixed wire basket assembly in secured relation to a door dike.

FIG. 5 is a cross-sectional cutaway view taken along the lines 5—5 in FIG. 4.

FIG. 6 is a back end-on view of the end cap shown in FIGS. 3, 4 and 5.

FIG. 7 is an interior side view of a tiltable basket assembly secured to the interior of the freezer door.

FIG. 8 illustrates, in isolation, a portion of the fixed basket assembly.

FIG. 9 depicts, in isolation, a portion of the tilt-out basket assembly.

FIG. 10 illustrates a single piece molded embodiment incorporating the end cap geometry of FIGS. 1–7 at both opposite lateral ends.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1, 2, 4 and 7 illustrate the interior side of an exemplary refrigerator door 10 of the type used for the freezer section of a domestic refrigerator unit having a lower freezer compartment and an upper refrigeration compartment. The door 10 to the freezer compartment is shown in the open position and having an inner plastic liner 12. It is noted that, while the invention is being described with respect to use with the door to a freezer compartment, it could as easily be utilized with the door to a refrigeration compartment. The plastic liner 12 has outwardly protruding vertical and horizontal door dikes 14 and 16 around the periphery of the liner 12. It is noted that only one vertical dike 14 and one horizontal dike 16 is shown. However, in actuality, these dikes 14 and 16 completely surround the periphery of the liner 12 (see, e.g., FIG. 10). Therefore, it should be understood that a second dike (not shown in FIGS. 1–9) similar to dike 14 is located on the opposite lateral side of the door 10. The inner liner 12 also includes a horizontal support ledge 18. The support ledge 18 extends most of, but not all of the way across the width of the door liner 12.

A rectangular mounting portion (one shown at 20) is located on the liner 12 adjacent each vertical dike 14. The mounting portion 20 includes a vertically disposed rectangular plate 22 that is disposed in a parallel relation to the dike 14. The plate 22 is joined to the inner surface of the dike 14 by a bottom web 24 along its lower edge and a lateral web 26 (see FIG. 2) along its rear edge. A recess 28 is formed at the forward edge of the portion 20, being defined between the dike 14 and the plate 22. A boss or lug 30 projects inwardly from each mounting portion 20. Each boss 30 has a generally rectangular shape with rounded corners.

Mounting portion 20, including boss 30, can be molded and an integral part of door liner 12, and in particular dike

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14 of door liner 12. As such, it can be plastic. Mounting portion 20 here is low profile in the sense it does not project forwardly ahead of dike 14, and does not extend very much inwardly or medially towards the dike on the other side of door liner 12 (e.g. an inch or less).

A basket assembly 32 is removably mountable to the liner 12 of the door 10 in order to retain food items within the door 10. The basket assembly 32 is made up of a wire frame holding portion with an end cap (one shown in FIG. 1) at either lateral end. There are two alternative embodiments for the wire frame holding portion described herein. FIG. 4 illustrates a fixed basket assembly 32 wherein the wire frame holding portion 34 is secured to the end caps 36 so that it does not move respect to the end caps 36. The wire frame holding portion 34 is shown apart from other components in FIG. 8. FIG. 7 depicts an alternative basket assembly 32' wherein the end caps 36 retain between them wire frame holding portion 34' that is tiltably moveable with respect to the end caps 36. The wire frame holding portion 34' is shown apart from other components in FIG. 9.

The construction of an exemplary end cap 36 is shown in FIGS. 3, 4, 5, 6 and 7. The end cap 36 is typically a unitarily molded plastic body that includes a forward decorative, or aesthetic, plate portion 40 and a rearward securing portion 42. The aesthetic plate portion 40 presents a curved outer face 44 which, as FIG. 5 shows best, provides a forward facing surface 46 located at the rear part of the aesthetic plate portion 40. The rear securing portion 42 of the end cap 36 features a plate member 48 that is shaped and sized to adjoin the plate 22 of the securing portion 20. The rearward side of surface 46 has a shaped tab 50 that is integrally formed with it. The tab 50 is shaped and sized to reside within the recess 28 in a downwardly sliding relation when the end cap 36 is secured to the liner 12. As shown in FIGS. 3, 5, and 6, tab 50 in this example has a main planar portion generally parallel to plate 48, but has several perpendicular ribs 51 that also fit within recess 28 (such that tab 50 and ribs 51 preferably frictionally fit therein). Ribs 51 can assist in strengthening tab 50. In addition, a substantially U-shaped channel 52 is formed out of raised ridges 54 that project outwardly from the plate member 48. The interior of the U-shaped channel 52 includes a pair of bumps 56 (see FIG. 3) that can extend substantially from wall 48 outwardly to the outer edges of raised ridges 48 and can be rounded in profile. Strengthening ribs 53 and 55 can be used to deter flexing of and strengthen ridges 48 defining U-shaped channel 52.

The channel 52 is shaped and sized to receive therein the boss 30 of the mounting portion 20 of the door liner 12. The bumps 56 restrict passage of boss 30 into and out of the channel 52 in order to create a snap-fit entry. The distance between the adjacent-most parts of bumps 56 on opposite sides of channel 52 is less than the widest width of boss 30. Boss 30 can have a opposite forward and rearward substantially flat faces defining the widest width of boss 30. But the lower edges of those opposite sides can be rounded or even tapered inwardly (see, e.g., FIG. 10). As boss 30 moves into channel 52, boss 30 interference fits through bumps 56, which move slightly outward by slight flexing of ridges 54. Bumps 56 can be positioned so that when boss 30 is fully inserted into channel 52, (FIG. 3), the flat opposite faces of boss 30 have moved past bumps 56 and thus boss 30 "snaps" into channel 52 in a basically locked position. Alternatively, bumps 56 could be positioned and configured to hold boss 30 in an interference type fit in channel 52.

The fit of boss 30 into channel 52 is illustrated in FIGS. 3, 4, 5, and 7. For clarity in the drawings, recess 28 of

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mounting portion 20 is shown in ghost lines, indicating generally the fit of tab 50 and ribs 52 into recess 28. The shape and location of tab 50/ribs 51 are shown in detail in FIGS. 3-7. The shape and location of recess 28 are shown in detail the FIGS. 1 and 2. It is to be understood that when end cap 36 is installed on mounting portion 20, tab 50 enters recess 28 and boss 30 on door dike 14 enters channel 52 on end cap 36 until boss 30 is seated and captured in channel 52. Tab 50 is also seated and substantially captured in recess 28.

The plate member 48 of the end cap 36 includes an inwardly projecting stop member 58. The lower end of the plate member 48 also contains two circular retaining recesses 60, 62 that are visible in FIGS. 4 and 7.

Turning now to FIGS. 8 and 9, the end portions of two alternative wire holding baskets 34, 34' are shown. These two baskets provide examples of the food retaining structures that may be used with the end caps 36 as part of a refrigerator shelf assembly. The two exemplary baskets 34, 34' are constructed in essentially the same manner using metal stock that has been welded at intersections to form the basket. Each basket 34, 34' includes a floor portion 64 and a wall portion 66. When the basket 34 or 34' is secured to the liner 12, food items are placed on the floor portion 64, and the wall portion 66 prevents the food items from falling off the floor portion 64. The wire basket 34, which is retained between two end caps 36 in a secured, non-movable relation, has a laterally-protruding rod portion 68 proximate the intersection of the floor portion 64 and the wall portion 66. In addition, there is a second laterally protruding rod portion 70 located proximate the rear of the floor portion 64. Again, it is pointed out that only one end of the wire basket 34 is shown in FIG. 8, and the opposite end of the wire basket, which is not shown, will have the same protruding portions. The wire basket 34 is affixed to an end cap 36 in the manner illustrated in FIG. 4 wherein the rod portion 68 is seated within the circular recess 60 and the rod portion 70 is seated within the circular recess 62.

The tiltable wire basket 34', as FIG. 9 shows, has a laterally protruding rod portion 68 located proximate the intersection of the floor portion 64 and the wall portion 66. However, there is no protruding rod portion 70. The wire basket 34' is secured to each end cap 36 as illustrated in FIG. 7. The rod portion 68 is seated within the circular opening 60 of each end cap 36 and the wire basket 34' can be tilted forwardly and outwardly with respect to the end caps 36 using the rod portions 68 as a pivot point, as illustrated in FIG. 7. As the basket 34' is tilted outwardly, the stop member 58 of each end cap 36 will eventually engage the floor portion 64, thereby limiting the amount by which the wire basket portion may be outwardly tilted. Use of a single end cap design that can accommodate both a fixed-relation and tiltable basket easily is advantageous.

In order to removably secure a basket assembly 32 or 32' to the liner 12, each end cap 36 is moved rearwardly onto the mounting portion 20 of the door dike 14. The end cap 36 is then moved downwardly so that the tab 50 is slid into the recess 28. In addition, the boss 30 of the mounting portion 20 enters the channel 52 of the end cap 36 in a snap-fit manner as the boss 30 is forced over or past the two bumps 56. Thus, a secure fit is provided by both the snap-fit mechanism provided by the channel 52 and boss 30 as well as the engagement of the tab 50 within the recess 28. Lateral movement of the basket assembly 32 or 32' is limited by the frictional engagement and trapping of the tab 50 within the recess 28. So is downward, frontward, and rearward movement. Upward movement is possible only if the snap-fit is

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overcome. Also, tabs 50 in recesses 28 deter lateral, downward, and rearward movement. The nature of restricting the gap width of entry into channel 52 with, for example, one or more bumps 56, provides a snap-fit retention or frictional retention that essentially locks end cap to the mounting portion. The end cap can be released by overcoming frictional retention or providing enough force to back the boss out of the snap-fit retention. This provides for a relatively low profile locking but easy release and removal without complex structure or utilizing deformable or deflecting pieces, such as described with regard to the prior art, which could over time break or cease to function properly. The forward-facing surface 46 of the end caps 36 provides a flush-mount flange that provides an aesthetically pleasing appearance. The rear end of the floor portion 64 of each wire basket 34, 34' rests on the horizontal support ledge 18 of the liner 12.

FIG. 10 illustrates in perspective view an alternative example of reversible securement of a structure to door 10. Here a one-piece molded plastic shelf 100 includes end caps 36 at opposite ends, but integrally formed therein, such that shelf 100 and end caps 36 comprise an integral one-piece apparatus. Vertical mounting structures, as previously described, receive corresponding mounting structure of end caps 36' (e.g. tab 50, U-shaped channel 52) to support and snap-fit rear securing portions 42 on opposite ends of shelf 100 to mounting portions 20 on opposite sides of liner 12 of door 10.

FIG. 10 therefore illustrates how a different structure can be releasably mounted with such mounting configuration. The structure can be of variety of things. Examples are baskets, shelves, or retaining members. The structure can also be support structure for any of a basket, shelf, or retaining member. As shown, the structure can be multi-pieced (e.g. the end caps separate from the basket, shelf, or retaining member), or can be integrated, including being one-piece (e.g. end cap and basket, shelf, or retaining member one-piece).

Those of skill in the art will recognize that many changes and modifications may be made to the devices and methods of the present invention without departing from the scope and spirit of the invention. Thus, the scope of the invention is limited only by the terms of the claims that follow and their equivalents.

What is claimed is:

1. A door retainer assembly for retaining food items in a refrigerator unit, comprising:
 - a door liner having a generally vertical dike on opposite lateral sides of the door liner;
 - at least one mounting portion spaced apart from each dike and having at least one connecting portion to connect the mounting portion to the dike;
 - a shelf assembly that is removably securable to the at least one mounting portion, the shelf assembly comprising:
 - a food-retaining shelf portion; and
 - a pair of end caps that retain the food-retaining shelf portion between them, each end cap adapted to releasably mount to one of the mounting portions.
2. The door retainer assembly of claim 1 wherein the end caps and shelf portion are one piece.
3. The door retainer assembly of claim 1 wherein:
 - the mounting portion further comprises a plate member disposed in a substantially parallel relation to the dike and defining a mounting portion space between the plate member and the dike; and

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the end caps each comprise a tab integrally formed therewith, the tab being shaped to be retained within the mounting portion space when the end caps are secured to the mounting portions.

4. The door retainer assembly of claim 3 wherein: the liner further comprises a boss that projects away from the dike; and

the end caps each further comprise a channel that is shaped to receive a boss when the end caps are secured to the mounting portions.

5. The door retainer assembly of claim 4 wherein the channel is formed of ridges that protrude outwardly from a surface of the end cap to define a substantially U-shaped channel.

6. The door retainer assembly of claim 5 wherein the channel includes at least one raised bump to restrict entry and exit of the boss from the channel.

7. The door retainer assembly of claim 4 wherein the boss projects from the mounting portion.

8. The door retainer assembly of claim 4 wherein the channel comprises a U-shape.

9. The door retainer assembly of claim 4 wherein the channel comprises a receiver with at least three sides.

10. The door retainer assembly of claim 9 wherein the channel is bounded by four sides.

11. The door retainer assembly of claim 9 wherein the receiver retains movement of the end cap when in place in substantially all but one direction.

12. The door retainer assembly of claim 3 wherein the tab comprises an elongated wall.

13. The door retainer assembly of claim 1 wherein the food-retaining shelf portion comprises a wire basket.

14. The door retainer assembly of claim 13 wherein the wire basket is retained between the end caps so that the wire basket is moveable tiltably with respect to the end caps.

15. The door retainer assembly of claim 13 wherein the wire basket is retained between the end caps in a non-moveable relation.

16. The door retainer assembly of claim 13 wherein each of the end caps comprise a substantially circular retaining recess and the wire basket comprises a protruding rod portion to reside within the retaining recess, the end caps being mountable to the wire basket by seating the protruding rod portions within the retaining recesses.

17. The door retainer assembly of claim 1 wherein the end caps each further comprise a plate portion having a forward-facing surface that overlies a portion of the dike when the end cap is secured to the mounting portions.

18. The door retainer assembly of claim 1 wherein the door liner further comprises a generally horizontally disposed ledge portion upon which the food-retaining shelf portion rests when the end caps are secured to the mounting portions.

19. The door retainer assembly of claim 1 wherein the vertical dike is of generally uniform thickness.

20. The door retainer assembly of claim 1 wherein the vertical dike extends substantially the full height of the liner.

21. The door retainer assembly of claim 1 wherein the mounting portion is integrally formed in the liner.

22. The door retainer assembly of claim 1 wherein the mounting portion comprises an elongated projection in the liner generally parallel to the dike but spaced from the dike to define the space between the dike and the mounting portion.

23. The door retainer assembly of claim 1 wherein to mounting portion is partially hollow in cross section.

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24. The door retainer assembly of claim 1 wherein the connecting portion comprises an interface between the dike and the mounting portion.

25. The door retainer assembly of claim 1 wherein the connecting portion comprises a wall integrally formed with the dike.

26. The door retainer assembly of claim 1 wherein the connecting portion comprises a web.

27. The door retainer assembly of claim 26 wherein the web comprises connecting material between the mounting portion and the dike.

28. The door retainer assembly of claim 26 wherein the web comprises a junction between the mounting portion and the dike.

29. The door retainer assembly of claim 26 wherein the web comprises a built-up section to hold the mounting portion in fixed relation to the dike.

30. The door retainer assembly of claim 1 wherein the mounting portion is formed in the door liner.

31. The door retainer assembly of claim 1 wherein the connecting portion comprises a web.

32. The door retainer assembly of claim 1 wherein the dike has a substantially uniform thickness or width.

33. The door retainer assembly of claim 1 wherein the end cap snap fits to a mounting portion.

34. A door retaining assembly for retaining food items in a refrigerator unit comprising:

a door liner having a pair of generally vertical dikes; at least one mounting portion located adjacent to each dike and comprising a substantially rectangular plate member that is connected to the dike by at least one connecting portion and defining a space between the plate member and the dike;

a shelf assembly that is removably securable to the mounting portions of the door liner, the shelf assembly comprising:

a food-retaining shelf portion; a pair of end caps that retain the food-retaining shelf portion between them, the end caps being mountable to the mounting portions, the end caps each having a tab to reside within the space between the plate member and the dike when the end cap is secured to one of said mounting portions.

35. The door retaining assembly of claim 34 further comprising a boss on the liner, and each end cap further comprising a channel shaped receive the boss.

36. The door retainer assembly of claim 35 wherein the boss projects from the mounting portion.

37. The door retainer assembly of claim 35 wherein the channel comprises a U-shape.

38. The door retainer assembly of claim 35 wherein the channel comprises a receiver with at least three sides.

39. The door retainer assembly of claim 38 wherein the channel is bounded by four sides.

40. The door retainer assembly of claim 38 wherein the receiver retains movement of the end cap when in place in substantially all but one direction.

41. The door retaining assembly of claim 34 wherein the food-retaining shelf portion comprises a wire basket.

42. The door retaining assembly of claim 34 wherein the pair of end caps and food-retaining shelf are one piece.

43. The door retainer assembly of claim 34 wherein the vertical dike is of generally uniform thickness.

44. The door retainer assembly of claim 34 wherein the vertical dike extends substantially the full height of the liner.

45. The door retainer assembly of claim 34 wherein the mounting portion is integrally formed in the liner.

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46. The door retainer assembly of claim 34 wherein the mounting portion comprises an elongated projection in the liner generally parallel to the dike but spaced from the dike to define the space between the dike and the mounting portion.

47. The door retainer assembly of claim 34 wherein the mounting portion is partially hollow in cross section.

48. The door retainer assembly of claim 34 wherein the connecting portion comprises an interface between the dike and the mounting portion.

49. The door retainer assembly of claim 34 wherein the connecting portion comprises a wall integrally formed with the dike.

50. The door retainer assembly of claim 34 wherein the connecting portion comprises a web.

51. The door retainer assembly of claim 50 wherein the web comprises connecting material between the mounting portion and the dike.

52. The door retainer assembly of claim 50 wherein the web comprises a junction between the mounting portion and the dike.

53. The door retainer assembly of claim 50 wherein the web comprises a built-up section to hold the mounting portion in fixed relation to the dike.

54. The door retainer assembly of claim 34 wherein the tab comprises an elongated wall.

55. The door retainer assembly of claim 34 wherein the mounting portion is formed in the door liner.

56. The door retainer assembly of claim 34 wherein the connecting portion comprises a web.

57. The door retainer assembly of claim 34 wherein the dike has a substantially uniform thickness or width.

58. The door retainer assembly of claim 34 wherein the end cap snap fits to a mounting portion.

59. An apparatus for releasably attaching a structure to a door liner of a door of a refrigerator unit, the door defining generally a plane, comprising:

(a) an end cap comprising

(a1) a male member, and

(a2) an interface for a food-retaining structure;

(b) a mounting portion formed in the door liner, the mounting portion defining

(b1) a space having an entrance facing substantially outwardly of the plane of the door and configured to receive the male member of the end cap and restrain it from movement generally in the direction of the plane of the door;

(b2) the mounting portion having a relatively low profile in relationship to the door liner;

(c) a boss extending substantially from the dike,

(d) the end cap further comprising a capture member having an interior space defined by a plurality of walls and an entrance, the capture member adapted to capture and resist exit of the boss when the end cap is mounted to the mounting portion and the boss passes through the entrance of the capture member, the capture member comprising a U-shaped member with the entrance adapted to be placed over the boss.

60. The apparatus of claim 59 wherein the interface comprises a pre-formed connection in the endcap adapted to receive a food-retaining portion of the structure.

61. The apparatus of claim 60 wherein the food-retaining structure is a shelf, a basket, or a retainer.

62. The apparatus of claim 59 wherein the interface is an integral junction with the food-retaining structure such that the end cap and the food-retaining structure is one piece.

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63. The apparatus of claim 59 wherein the door liner comprises first and second vertical dikes and wherein the mounting portions are positioned at or near the vertical dikes respectively of the door liner.

64. The apparatus of claim 59 wherein the door liner comprises a top, a bottom and opposite sides each having a forwardmost surface, and the relatively low profile of the mounting portion does not extend beyond the forwardmost surface of the opposite side of the door liner adjacent to it.

65. The apparatus of claim 64 wherein the relatively low profile of the mounting portion does not extend substantially medially of the door liner.

66. The apparatus of claim 59 further comprising at least one raised portion on the interior of the U-shaped member such that the boss is snap-fit into the U-shaped member when moved sufficiently through the entrance.

67. The apparatus of claim 59 wherein the male member and the boss simultaneously can be inserted into the recess and capture member respectively when the end cap is installed on the mounting portion to support and hold the end cap against movement in any direction unless sufficient removing force in a removal direction is applied to release the capture member from the boss.

68. The apparatus of claim 59 wherein the capture member has a restricted cross-section into which the boss can be manually forced and to resist removal of the boss against release absent sufficient removing force in a removal direction.

69. The apparatus of claim 59 wherein the recess comprises a space bounded by walls on four sides.

70. The apparatus of claim 59 wherein the door liner has a top, bottom and opposite sides and the entrance to the recess is generally in an outward and topward direction.

71. A door retainer assembly for retaining items in a refrigerator unit comprising:

a door liner having a generally vertical dike on opposite lateral sides of the door liner and at least one mounting portion spaced apart from each dike, wherein the mounting portion includes at least one connecting portion to connect the mounting portion to the dike, the mounting portion comprising an elongated projection having one generally planar surface spaced from and facing the vertical dike to define a space therebetween; a shelf assembly adapted for removeable securement to the at least one mounting portion of the door liner, the shelf assembly comprising a shelf portion and a pair of end caps that retain the shelf portion between them, each end cap adapted to releasably mount to one of said mounting portions, each end cap having a male member adapted to fit in the space between the mounting portion and the dike and having a receiver adapted to snap fit over a boss extending from the dike.

72. A door retaining assembly for retaining food items in a refrigerator unit comprising:

a door liner having a pair of generally vertical dikes and at least one mounting portion spaced apart from each dike, wherein the mounting portion includes a member having a generally flat surface facing but spaced apart from the dike and connected to the dike by at least one connecting portion wherein the mounting portion defines a space between the elongated member and the dike; and

a shelf assembly that is removeably securable to the mounting portions, the shelf assembly comprising:

a shelf portion;

a pair of end caps that retain the shelf portion between them, the end caps being selectively mountable to

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the mounting portions of the door liner, the end caps each having a male member adapted to reside within the space by the mounting portion when the end cap is secured to the mounting portion; and
 a receiver adapted to receive a boss extended from the dike.

73. A refrigerator unit having a door retaining assembly for retaining food items, the door retaining assembly having the advantage of secure but reversible mounting of a food-retaining assembly to the refrigerator, the refrigerator unit comprising:

a body, a door, and a refrigeration system;

the door comprising a door liner having a generally vertical dike on opposite lateral sides of the door liner and a mounting portion located adjacent to each dike having at least one connecting portion to connect the mounting portion to the dike, the mounting portion comprising an elongated projection having one generally planar surface spaced from but facing the vertical dike to define a space therebetween;

a shelf assembly adapted for removeable securement to the mounting portions, the shelf assembly comprising a shelf portion and a pair of end caps that retain the shelf portion between them, each end cap adapted to releasably mount to a said mounting portion, each end cap having a male member adapted to fit in the space between the mounting portion and the dike and having a receiver adapted to snap fit over a boss extending from the dike.

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74. A refrigerator unit having a door retaining assembly for retaining food items, the door retaining assembly having the advantage of secure but reversible mounting of a food-retaining assembly to the refrigerator, the refrigerator unit comprising:

a body, a door, and a refrigeration system;

a door liner having a pair of generally vertical dikes, a mounting portion located adjacent to each dike comprising a member having a generally flat surface facing but spaced apart from the dike and connected to the dike by at least one connecting portion, wherein the mounting portion defines a space between the elongated member and the dike;

a shelf assembly that is removeably securable to the door liner, the shelf assembly comprising:

a shelf portion;

a pair of end caps that retain the shelf portion between them, the end caps being selectively mountable to the mounting portions of the door liner, the end caps each having a male member adapted to reside within the space by the mounting portion when the end cap is secured to the mounting portion;

a receiver adapted to receive a boss extending from the dike.

* * * * *

EXHIBIT 13

(12) **United States Patent**
Collins et al.

(10) **Patent No.:** **US 7,293,846 B2**
(45) **Date of Patent:** **Nov. 13, 2007**

(54) **STORAGE BIN ASSEMBLY FOR A REFRIGERATOR**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 256 days.

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(22) Filed: **Oct. 15, 2004**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
A47B 96/16 (2006.01)

(52) **U.S. Cl.** **312/405.1**; 312/404; 312/321.5;
312/348.4; 312/365.6; 220/661

(58) **Field of Classification Search** 312/405.1,
312/404, 407, 407.1, 321.5, 265.5, 265.6,
312/327, 328, 406.2, 408; 220/661, 345.1,
220/676, 677, 811, 812, 813

See application file for complete search history.

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Primary Examiner—Lanna Mai

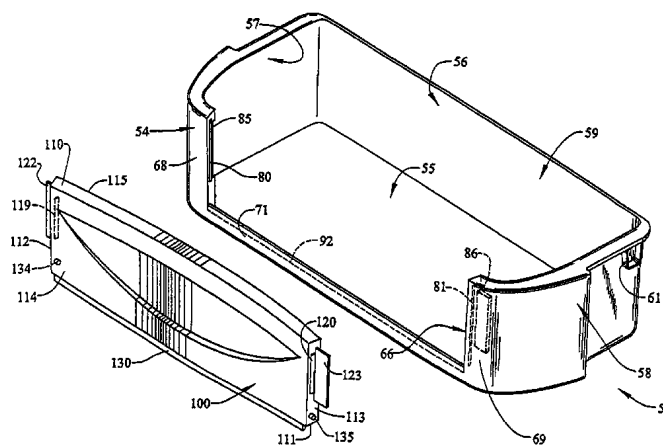
Assistant Examiner—Mart K Kuhn

(74) *Attorney, Agent, or Firm*—Michael D. Lafrenz; Kirk Goodwin

(57) **ABSTRACT**

A refrigerator includes a storage bin assembly removably mounted to an inner liner of a door. The storage bin assembly includes a base portion having a frontal opening, and a face portion. The frontal opening is defined by first and second side portions, as well as a bottom portion. Each of the side portions is provided with a mounting component and a mounting element. The face portion includes top, bottom and opposing side sections, with each of the opposing side sections being provided with a mounting member and a mounting part. The mounting component interengages with the mounting member and the mounting element interengages with the mounting part upon snap-fittingly securing the face portion to the base portion across the frontal opening.

19 Claims, 12 Drawing Sheets



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FIG. 1

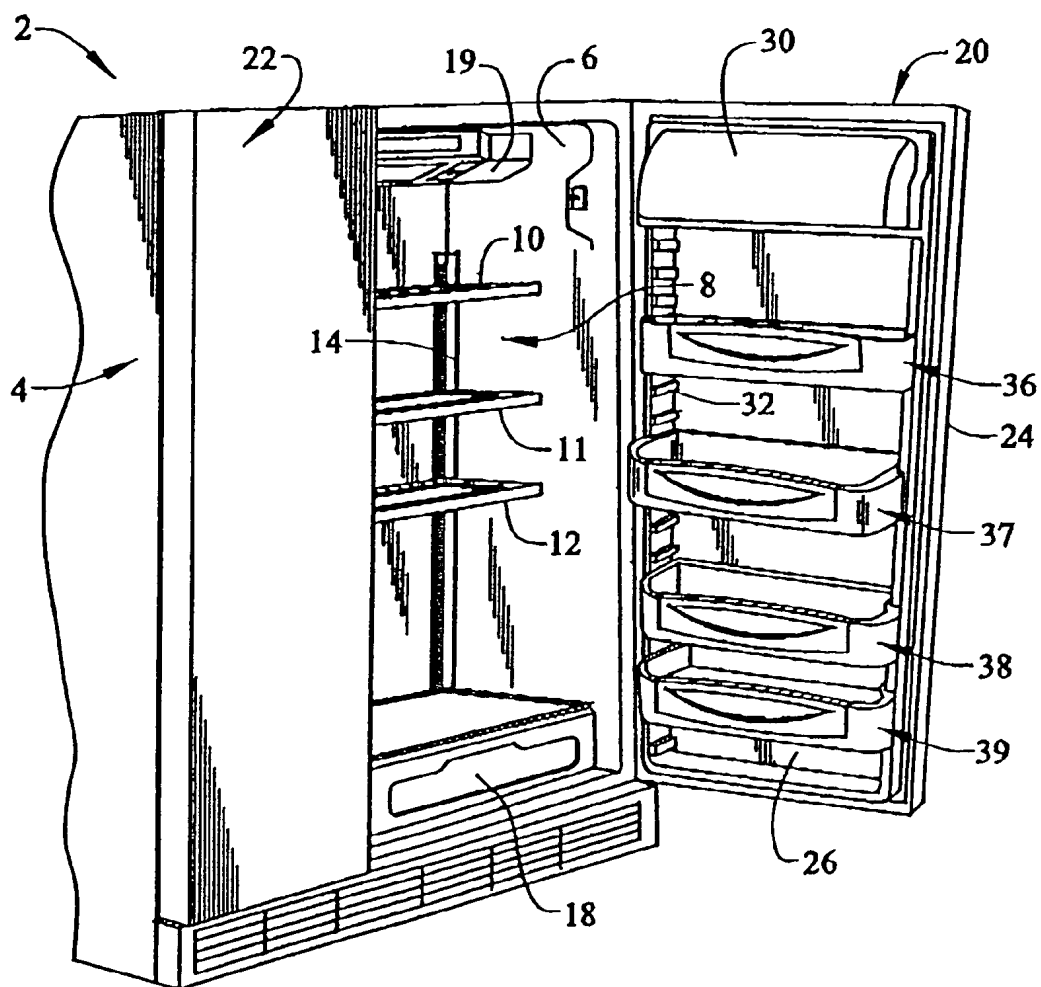


FIG. 2

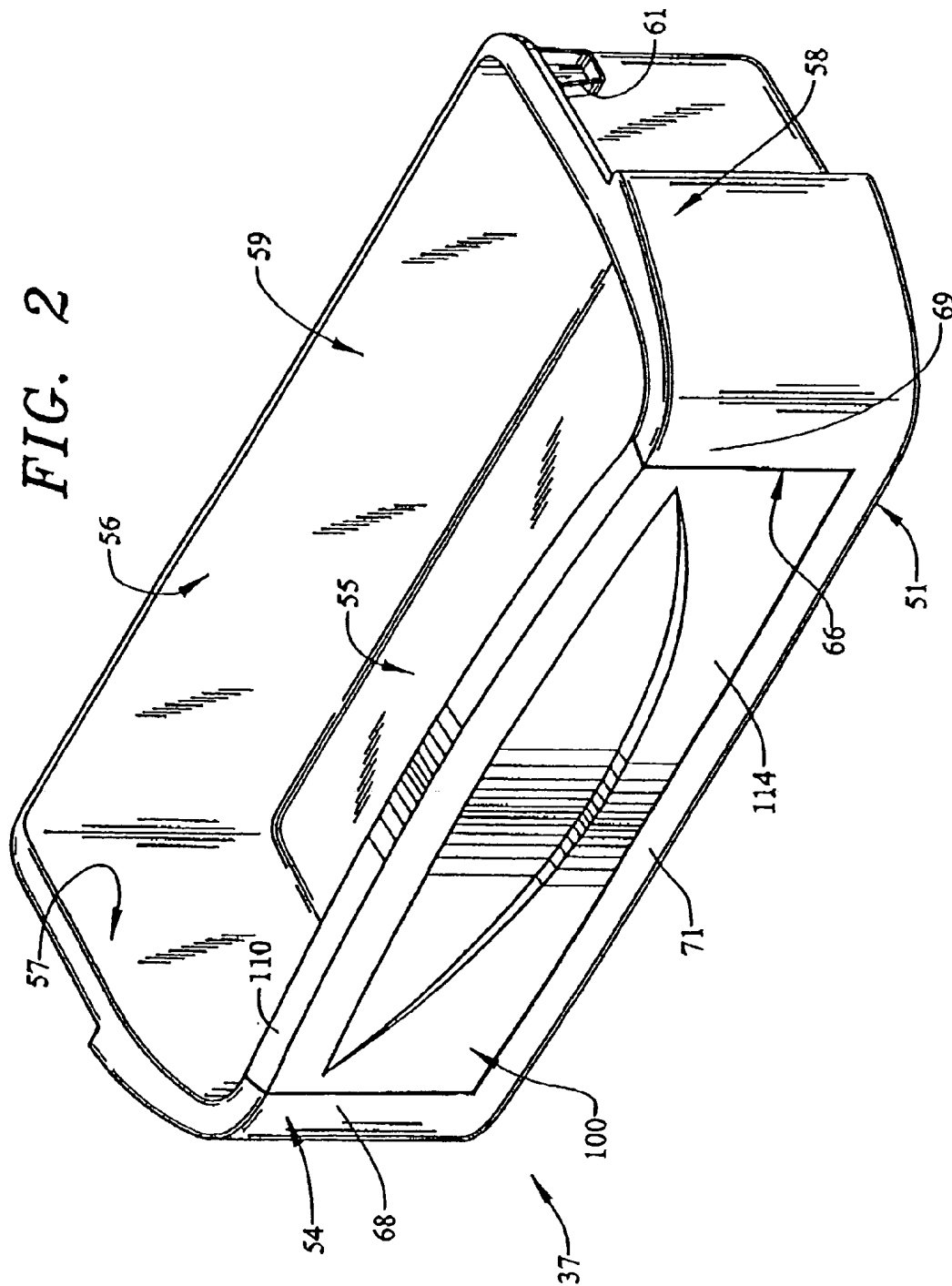


FIG. 3

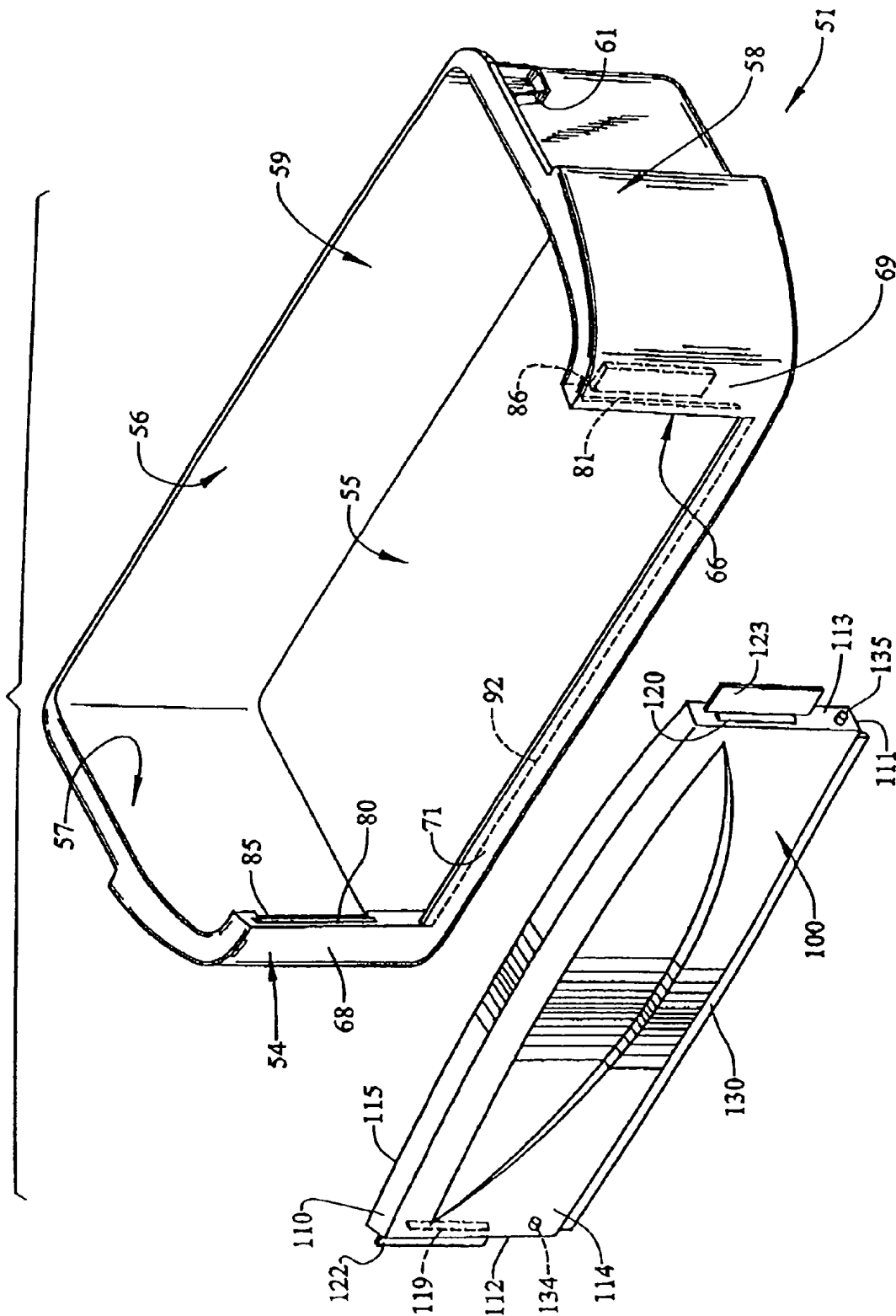
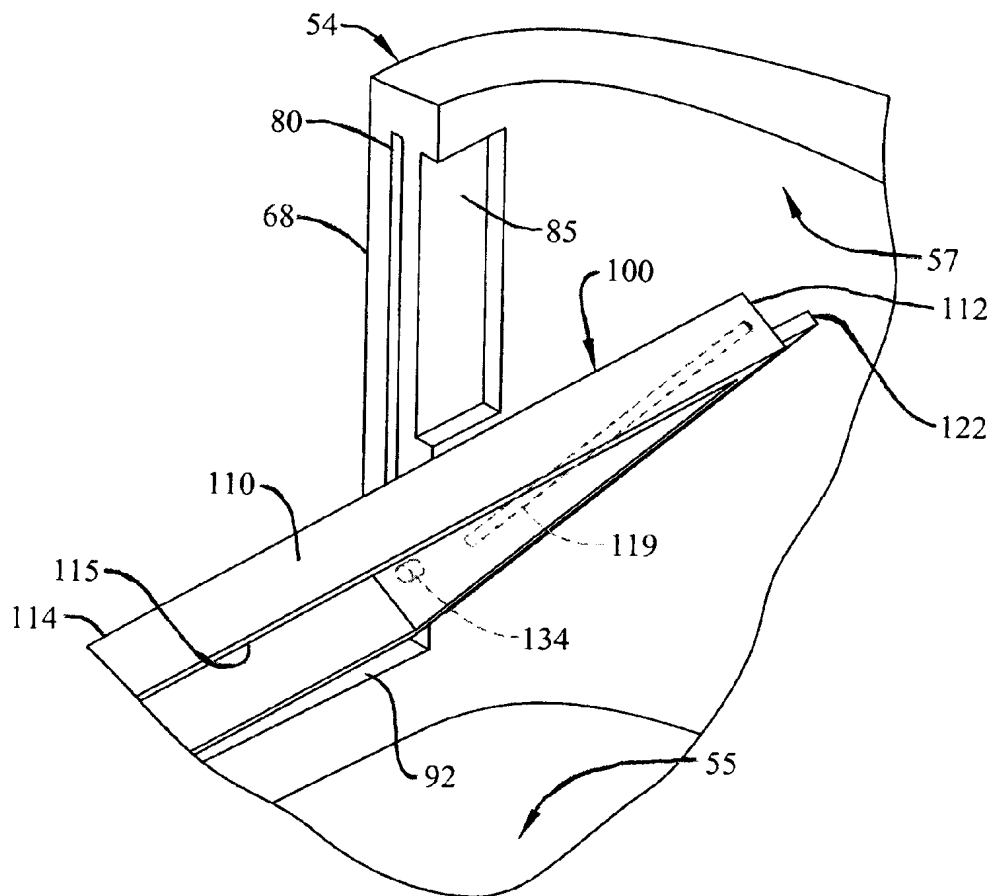


FIG. 4B



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FIG. 5

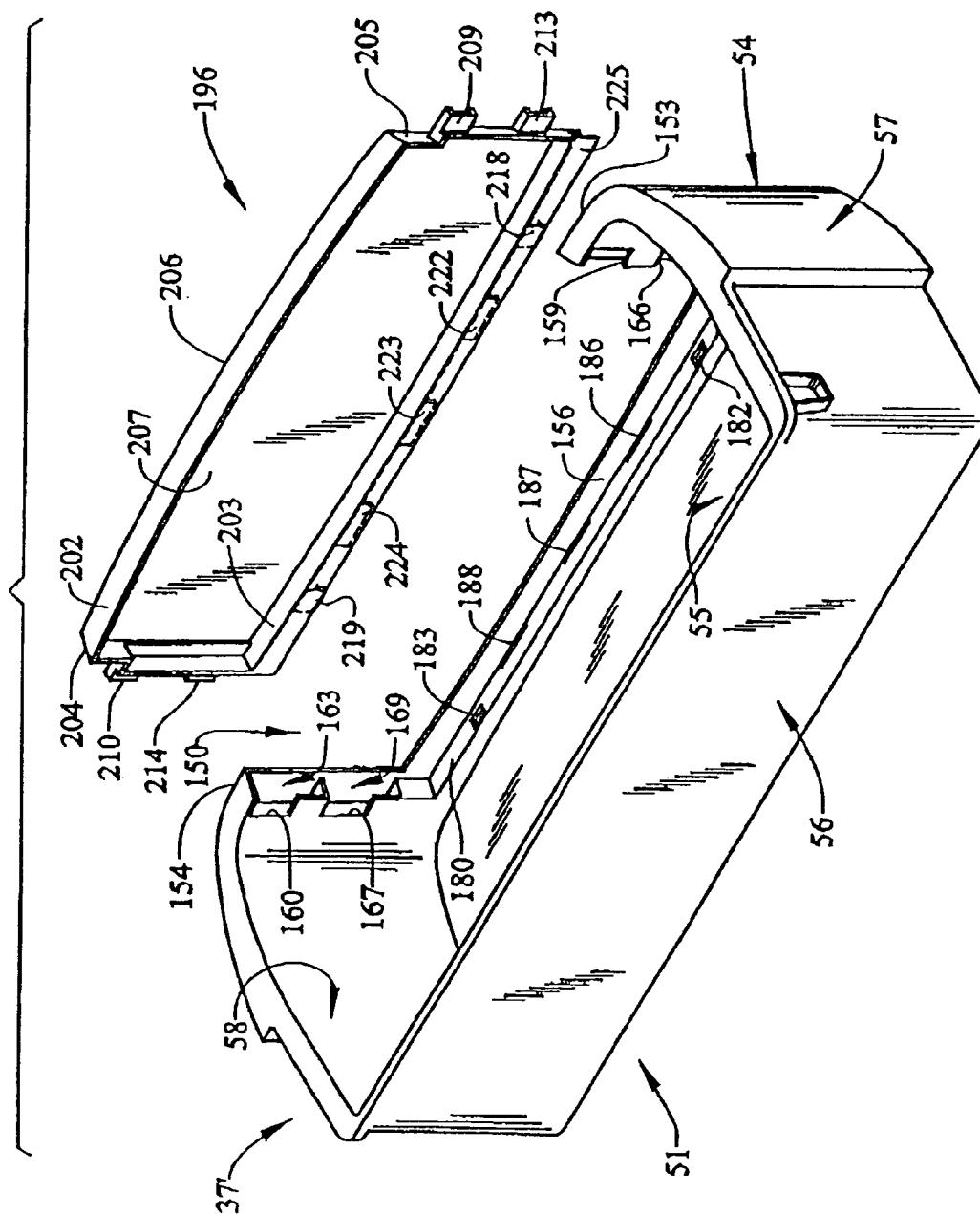


FIG. 6

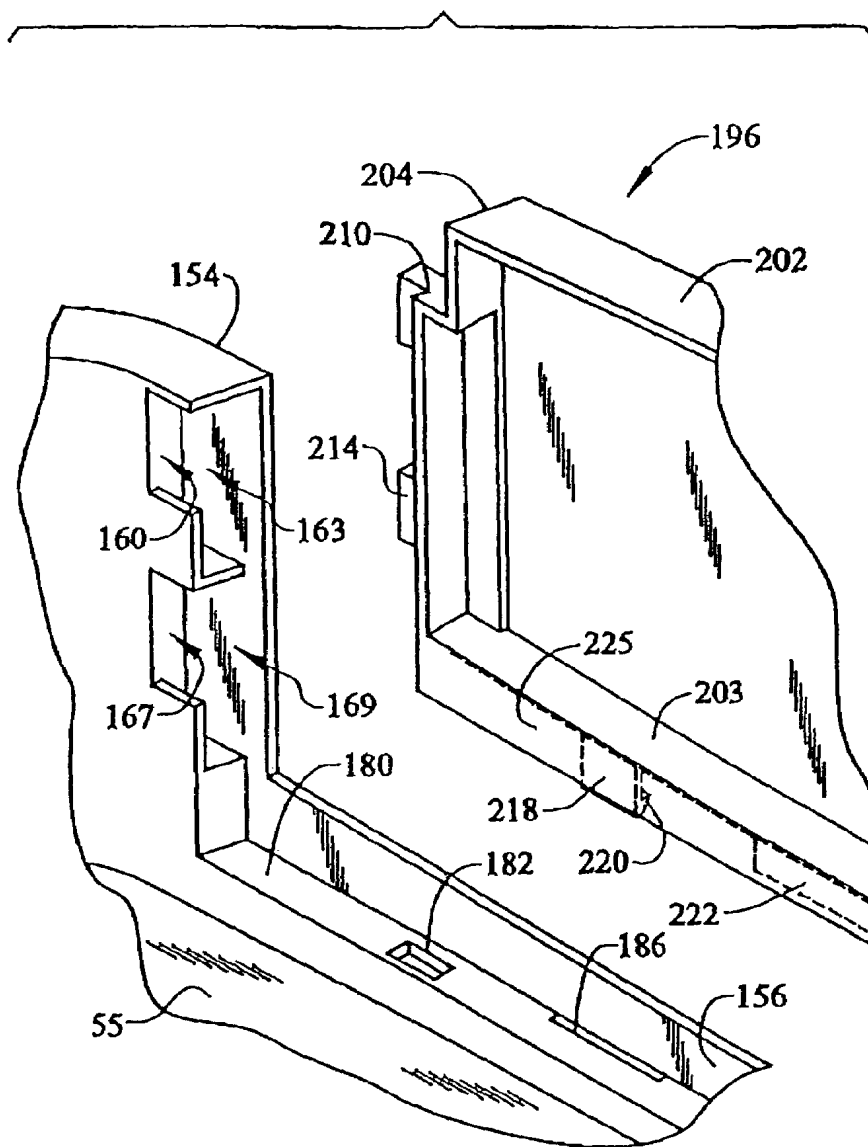


FIG. 7

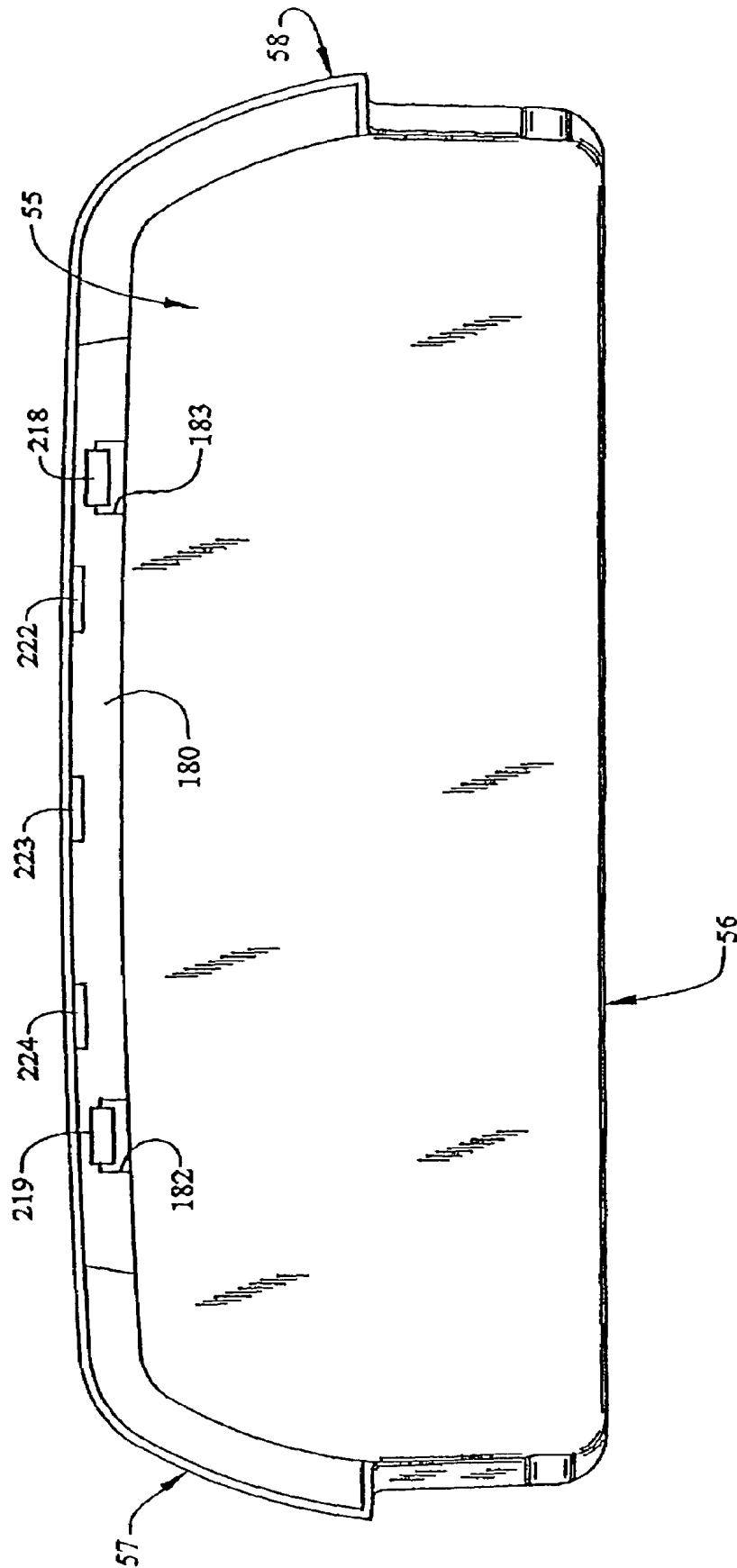


FIG. 8

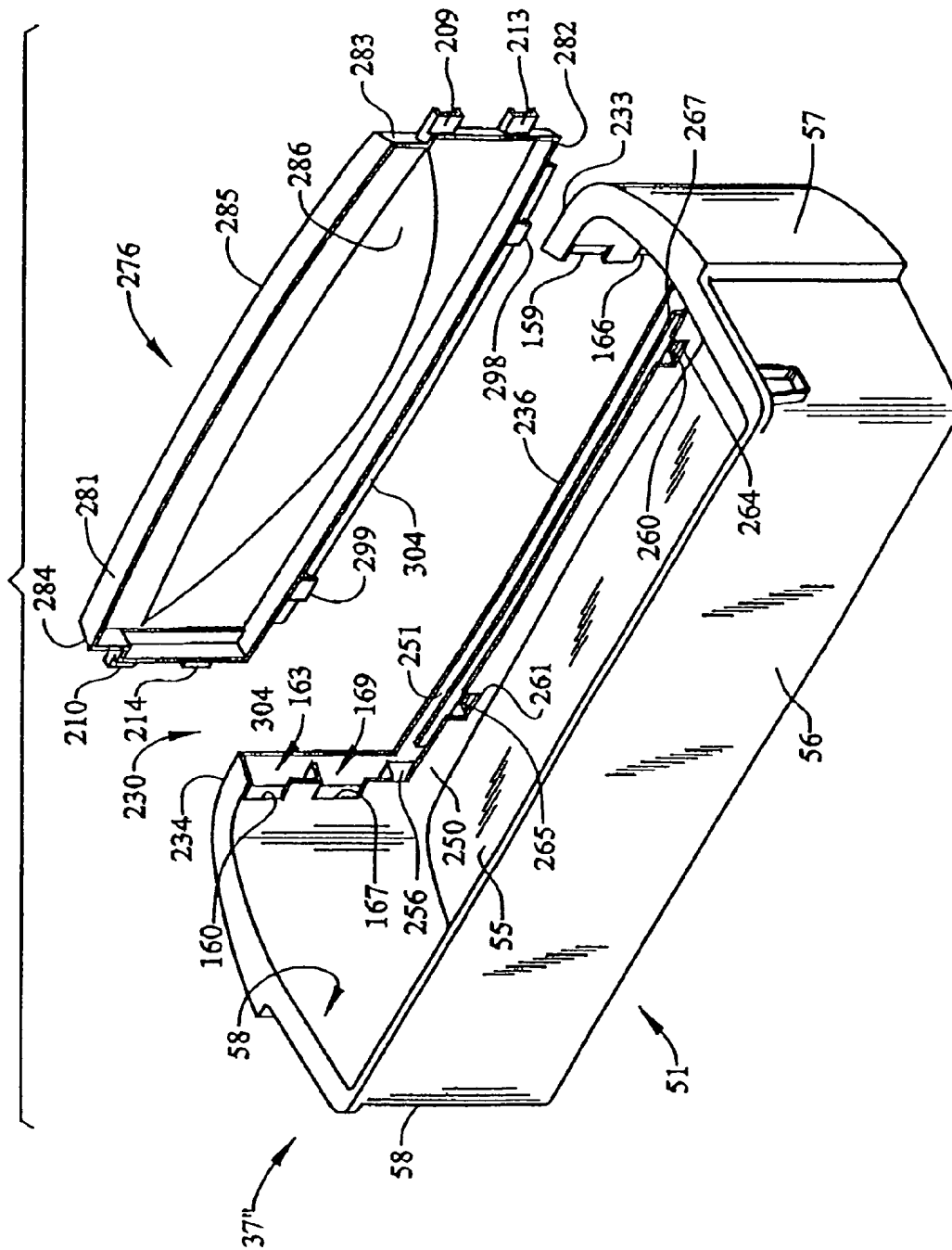


FIG. 9

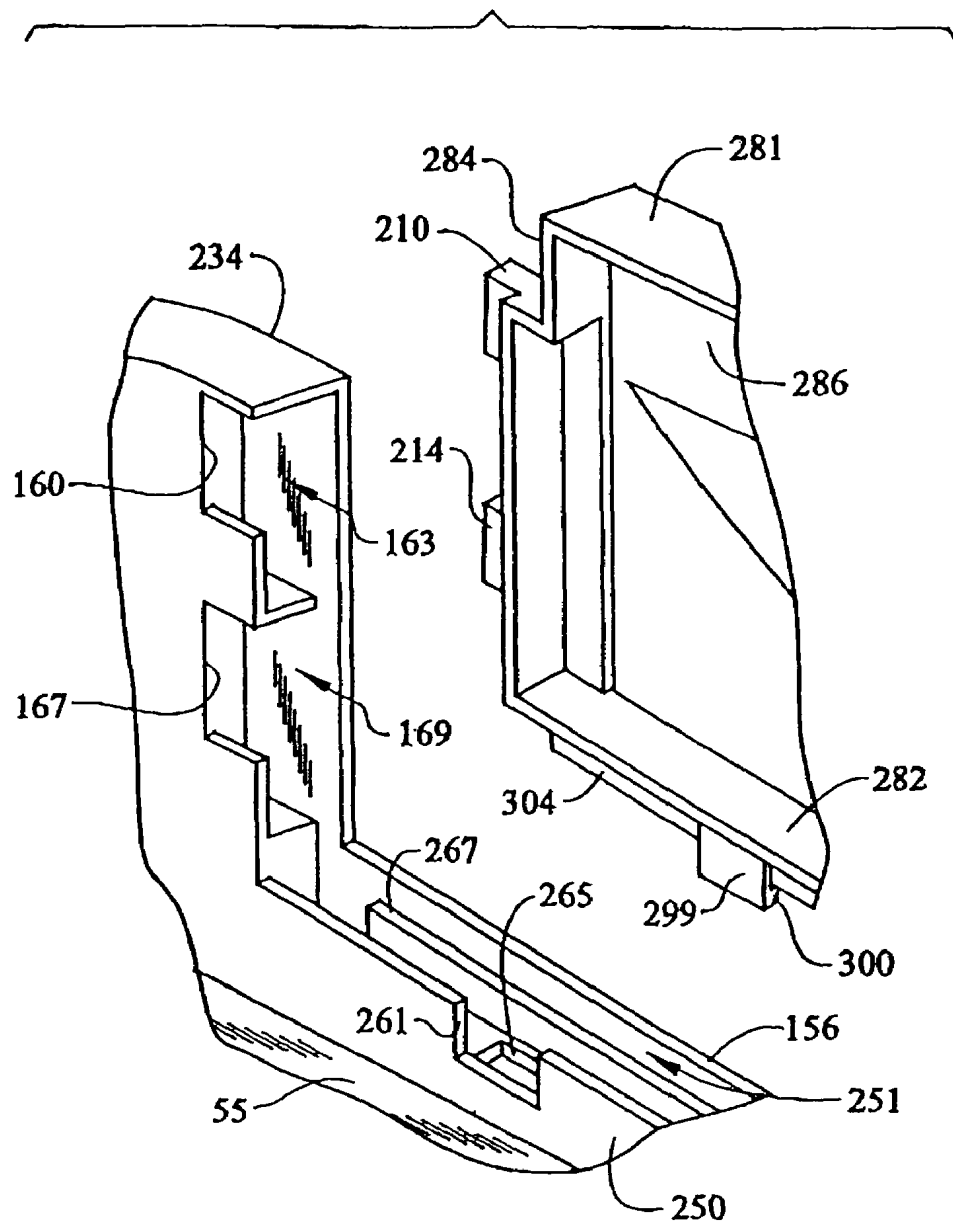


FIG. 10

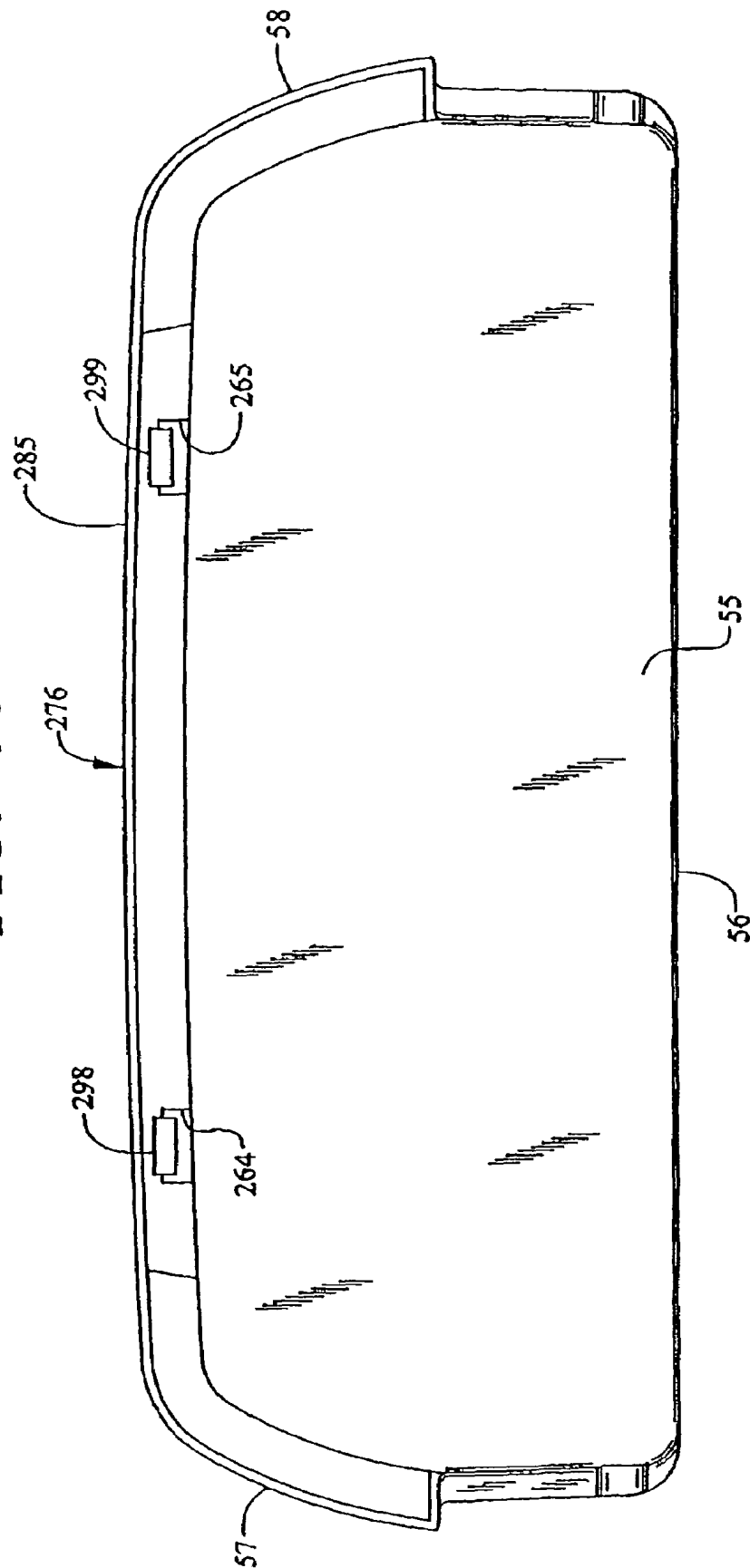
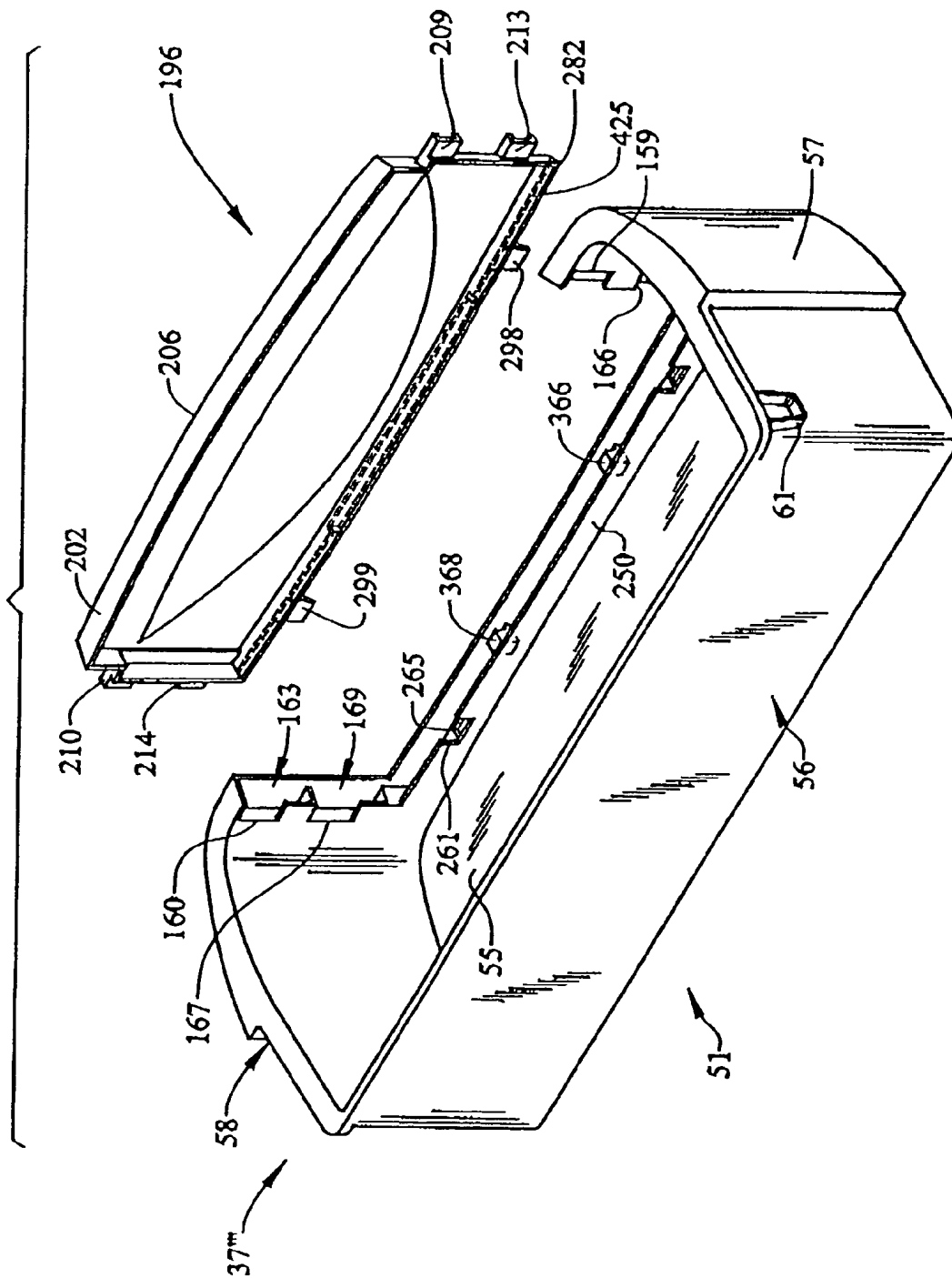


FIG. 11



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STORAGE BIN ASSEMBLY FOR A REFRIGERATOR**BACKGROUND OF THE INVENTION****1. Field of the Invention**

The present invention pertains to the art of refrigerators and, more particularly, to a storage bin assembly for retaining articles on a door of a refrigerator.

2. Discussion of the Prior Art

It is well known in the art of refrigerated appliances to form doors having inner liners that are provided with structure to support storage units for retaining various food containers. Typically, the storage units are in the form of fixed or removable bins that are supported by the door. The removable bins can be arranged at various positions on the inner liner to provide adequate spacing for food items and containers having varying heights.

In many cases, the bins are of a unitary construction and typically injection molded from plastic. In other cases, the bins are formed from multiple pieces that enable designers to construct creative shapes and/or tailor the bins to meet particular consumer tastes. Multiple-piece bins generally take the form of a base portion to which is attached a unique facade. The facade can either be opaque or transparent and shaped or formed with various designs that enable the bin to blend or otherwise compliment aesthetic features present in the refrigerator.

The prior art contains a number of examples of multi-piece bins, as well as methods of attaching a facade to a base portion. Ideally, the base portion is designed so as to cooperate with a wide range of appliance platforms and to accept a wide variety of facades. In this manner, a single base portion can be employed to create a number of different storage bin configurations for use in various appliance models. The prior art contains examples of securing facades to the base portion through use of adhesives, sonic welding or through a simple snap-in arrangement. While each method has a particular advantage, the snap-in arrangement results in lower manufacturing costs.

Despite the existence of multi-piece storage bins in the prior art, there still exists a need for simple, cost effective and robust mounting arrangements for securing facades to bases of multi-piece storage bins.

SUMMARY OF THE INVENTION

The present invention is directed to storage bin assembly that can be selectively and removably mounted to an inner liner of a refrigerator door. In accordance with the invention, the storage bin assembly includes a base portion, along with a facade or face portion. The base portion includes front, bottom, rear and opposing side walls that collectively define a storage cavity. The front wall is formed with a frontal opening that is collectively defined by first and second side portions and a bottom portion of the front wall.

In further accordance with the invention, each of the first and second side portions of the front wall is provided with both a mounting element and a mounting component. Additionally, the bottom portion of the front wall is provided with a recess for receiving a bottom section of the face portion. Furthermore, side sections of the face portion are provided with both mounting members that engage with the mounting component on the frontal wall and a mounting part that engages with the mounting element of the frontal wall to detachably secure the face portion to the base portion.

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In accordance with one embodiment, the mounting component and mounting element are constituted by a slot and a depression respectively. The mounting member and mounting part are constituted by a raised rib and a flange respectively. In addition, each side portion is provided with a boss or pin. With this arrangement, the pin is inserted into the slot. Thereafter, the face portion is shifted until the raised rib snaps into the slot in order to secure the face portion in the frontal opening of the base portion. Once in place, the flange nests within the depression to prevent forward excursion of the face portion.

In accordance with another embodiment, the mounting element and mounting component are constituted by first and second notches formed in a rear surface of the first and second side portions, while the mounting member and mounting part are constituted by first and second fingers that project from each of the opposing side sections of the face portion. Each notch opens into a slot that extends toward the bottom portion of the front wall. To mount a face portion to a base portion of a storage bin assembly constructed in accordance with this embodiment, the fingers are initially aligned with and inserted into respective notches. Thereafter, the face portion is shifted downward such that the fingers are retained within the slot. To provide a more robust attachment, a recessed portion of the front wall is provided with at least one aperture, and the bottom section of the face portion includes a tab. When the face portion is shifted into place, the tab extends into the aperture and engages the base portion.

In accordance with other embodiments of the present invention, the recess formed in the bottom portion of the front wall is provided with structure to properly align the face portion with the base portion. In accordance with a third embodiment of the invention, the structure is constituted by a guide member that extends across the frontal opening at the recess. In accordance with a fourth embodiment of the invention, the structure is constituted by mounting blocks arranged in the recess.

Additional objects, features and advantages of the present invention will become more readily apparent from the following detailed description of the preferred embodiments when taken in conjunction with the drawings wherein like reference numerals refer to corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial, perspective view of a side-by-side refrigerator incorporating a storage bin assembly constructed in accordance with the present invention;

FIG. 2 is an upper right perspective view of the storage bin assembly constructed in accordance with the invention;

FIG. 3 is an exploded view of the storage bin assembly of FIG. 2;

FIG. 4A is an upper right perspective view of the storage bin assembly of FIG. 2, illustrating a face portion of the storage bin assembly being secured to a base portion thereof;

FIG. 4B is a detail view of a front corner portion of the storage bin assembly of FIG. 4A;

FIG. 5 is an exploded, upper rear perspective view of a storage bin assembly constructed in accordance with a second embodiment of the present invention;

FIG. 6 is a detail view of a front corner portion of the storage bin assembly of FIG. 5;

FIG. 7 is a bottom view of the storage bin assembly of FIG. 5;

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FIG. 8 is an exploded, upper rear perspective view of a storage bin assembly constructed in accordance with a third embodiment of the present invention;

FIG. 9 is a detail view of a front corner portion of the storage bin assembly of FIG. 8;

FIG. 10 is a bottom view of the storage bin assembly of FIG. 8; and

FIG. 11 is an exploded, upper rear perspective view of a storage bin assembly constructed in accordance with a fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With initial reference to FIG. 1, a refrigerator, generally indicated at 2, is shown to include a cabinet shell 4 which is provided with a liner 6. As shown, liner 6 defines a fresh food compartment 8 which, in a manner known in the art, is provided with a plurality of shelves 10-12 for supporting various food articles and the like. Shelves 10-12 are adjustably mounted upon a pair of shelf rails, one of which is indicated at 14. Arranged below shelves 10-12 is a crisper bin 18 which, in a manner known in the art, provides a controlled environment for select food items. Positioned at an upper portion of fresh food compartment 8 is a control housing 19 which enables a consumer to set various settings for refrigerator 2.

In a manner known in the art, refrigerator 2 is also shown to include a fresh food door 20 which selectively extends across fresh food compartment 8. In a manner also known in the art, refrigerator 2 is provided with a freezer door 22 that selectively closes a freezer compartment (not shown). In any event, fresh food door 20 is shown to include an outer shell 24 and an inner liner 26. Arranged at an upper portion (not separately labeled) of inner liner 26 is a compartment 30 for holding butter and the like. Additionally, side portions (not separately labeled) of inner liner 26 are provided with a plurality of support rails one of which is indicated at 32, which enable a consumer to selectively position a plurality of storage bins 36-39 on inner liner 26. Although storage bins 36-39 could be formed in various ways, each storage bin 36-39 is preferably injection molded as two-pieces which are assembled as discussed further below with reference to storage bin 37.

Reference will now be made to FIGS. 2-4 in describing storage bin 37 constructed in accordance with one preferred embodiment of the invention. As shown, storage bin 37 includes a base portion 51 having a front wall 54, bottom wall 55, rear wall 56, and opposing side walls 57 and 58 that collectively define a storage cavity 59. In a manner known in the art, arranged on each opposing side wall 57, 58 is a support lug 61. Support lug 61 is designed to cooperate with support rails 32 on inner liner 26 to position and retain storage bin 37 on fresh food door 20. As best shown in FIGS. 3 and 4, base portion 51 includes a frontal opening 66 defined by a first side portion 68, a second side portion 69 and a bottom portion 71 of front wall 54.

In accordance with the invention, first and second side portions 68 and 69 are provided with corresponding first and second mounting components 80 and 81. First and second side portions 68 and 69 are also provided with corresponding first and second mounting elements 85 and 86. In accordance with the embodiment shown, first and second mounting components 80 and 81 are constituted by slots formed in first and second side portions 68 and 69 respectively, while first and second mounting elements 85 and 86 are constituted by depressions formed on a rear side (not

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separately labeled) of first and second side portions 68 and 69. In addition, bottom portion 71 is provided with a recess 92 that, in combination with mounting components 80 and 81 and mounting elements 85 and 86, function to retain a face portion 100 of storage bin 37 across frontal opening 66. Preferably, face portion 100 is formed from a plastic-like material that can be either transparent or opaque. In addition, face portion 100 can be molded with various different designs depending upon the particular model type of refrigerator 2 into which storage bin 37 is to be incorporated.

In any event, regardless of the particular material used, face portion 100 includes a top section 110, a bottom section 111 and opposing side sections 112 and 113 which surround a front surface 114 and a rear surface 115. In accordance with the embodiment shown, opposing side sections 112 and 113 are provided with corresponding first and second mounting members 119 and 120, as well as first and second mounting parts 122 and 123. As shown, each mounting member 119, 120 is constituted by a raised, laterally projecting rib, while each mounting part 122, 123 is constituted by a lateral flange. In order to secure face portion 100 to base portion 51 while, at the same time, prevent forward excursion of face portion 100 beyond front wall 54, mounting members 119 and 120 are adapted to interengage with mounting components 80 and 81 on first and second side portions 68 and 69. In addition, mounting parts 122 and 123 are formed so as to engage with, and actually nest within, mounting elements 85 and 86. Furthermore, in order to ensure that a seamless fit is achieved between face portion 100 and base portion 51, bottom section 111 is provided with a lip 130 that projects within recess 92 in bottom portion 71. To still further aid in the overall positioning and mounting of face portion 100 to base portion 51, a respective pin or boss 134, 135 is provided on a lower section (not separately labeled) of each opposing side section 112 and 113.

Face portion 100 is actually snap-fittingly secured to base portion 51 through interengagement of mounting members 119 and 120 with mounting components 80 and 81, as well as the engagement of mounting parts 122 and 123 with mounting elements 85 and 86. More specifically, with particular reference to FIG. 4, pins 134 and 135 are initially positioned within first and second mounting components 80 and 81. At this point, face portion 100 is rotated upward so that first and second mounting members 119 and 120 snap into first and second mounting components 80 and 81 while the first and second mounting parts 122 and 123 abut and nest within mounting elements 85 and 86. With lip 130 resting within recess 92, an overall seamless appearance is established for storage bin 37 as clearly represented in FIG. 2.

Reference will now be made to FIGS. 5-7 in describing a second embodiment of the present invention where like reference numbers refer to corresponding parts in the various views. In accordance with the embodiment shown, a of storage bin 37 includes a base portion 51 that is provided with a frontal opening 150. Frontal opening 150 includes first and second side portions 153 and 154, as well as a bottom portion 156. Each side portions 153, 154 is provided with mounting components 159 and 160 defined by openings formed in rear sections (not separately labeled) of side portions 153 and 154. Mounting components 159 and 160 are constituted by notches that lead into respective slots, one of which is shown at 163. In addition to mounting components 159 and 160, side portions 153 and 154 are provided with mounting elements 166 and 167 which are also defined by notches formed on rear sections (not separately labeled) of side portions 153 and 154 that lead into respective slots,

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such as indicated at 169. In the embodiment shown, mounting elements 166 and 167 are actually positioned below mounting components 159 and 160. In addition, bottom portion 156 is provided with a recess 180 having a plurality of openings 182 and 183, as well as a plurality of slots 186-188, the details of which will be provided more fully below.

In a manner similar to that described above, frontal opening 150 is adapted to receive a face portion 196 that provides a seamless appearance for storage bin 37'. Toward that end, face portion 196 includes a top section 202, a bottom section 203 and opposing side sections 204 and 205 which define a front surface 206 and a rear surface 207. Each opposing side section 204, 205 includes a corresponding mounting member 209, 210, as well as a corresponding mounting parts 213, 214. In the embodiment shown, each mounting member 209, 210 and mounting parts 213, 214 is constituted by a square-shaped lug or finger which is adapted to engage with a corresponding one of mounting components 159 and 160 and mounting elements 166 and 167. In addition, bottom section 203 is provided with a plurality of clips 218 and 219, each having an associated hook element 220 (see FIG. 6) that are sized to extend into openings 182 and 183 respectively. In order to ensure proper positioning of face portion 196, a plurality of tabs 222-224 are also formed on bottom section 203 and are designed to extend into slots 186-188 respectively. Finally, bottom section 203 is also provided with a lip 225 used in mounting face portion 196 as detailed further below.

With this construction, face portion 196 is joined to base portion 51 by simultaneously aligning and inserting mounting members 209 and 210 and mounting parts 213 and 214 into mounting components 159 and 160 and mounting elements 166 and 167 respectively. At this point, face portion 196 is shifted downward such that mounting members 209 and 210 and mounting parts 213 and 214 move through slots 163 and 169 allowing clips 218 and 219 and tabs 222-224 to extend through openings 182 and 183 and slots 186-188 respectively. Once face portion 196 is fully seated, hooks 220 and 221 engage with bottom portion 55 of base portion 51, while a rear surface of side portions 153 and 154 retain mounting members 209 and 210 and mounting parts 213 and 214 to snap-fittingly retain face portion 196 to base portion 51.

Reference will now be made to FIGS. 8-10 in describing a third embodiment of the present invention wherein like reference numbers refer to corresponding parts in the various views. As shown, storage bin 37" includes a base portion 51 having a frontal opening 230. Frontal opening 230 includes first and second side portions 233 and 234, as well as a bottom portion 236. In a manner similar to that described above with respect to frontal opening 150, first and second side portions 233 and 234 include corresponding first and second mounting components 159 and 160 defined by notches or openings that lead into a slot 163. Likewise, side portions 233 and 234 are provided with corresponding first and second mounting elements 166 and 167 which lead into associated slots 169.

In further accordance with the embodiment shown, bottom portion 236 includes an inner wall portion 250 spaced from an outer wall portion 251 by a central recess 256. Inner wall portion 250 includes a pair of notches 260 and 261 which are positioned adjacent openings 264 and 265 provided in recess 256. In addition to openings 264 and 265, a guide member 267 is formed within recess 256 which assists in the overall positioning of a front face portion 276 in a manner as will be discussed more fully below.

In a manner similar to that described with respect to the previous embodiments, a frontal opening 230 is fitted with a face portion 276 including a top section 281, a bottom

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section 282, opposing side sections 283 and 284, a front surface 285 and a rear surface 286. Opposing side sections 283 and 284 of face portion 276 are provided with corresponding first and second mounting members 209 and 210 as well as corresponding first and second mounting parts 213 and 214. Mounting members 209 and 210 and mounting parts 213 and 214 are adapted to interengage with mounting components 159 and 160 and mounting elements 166 and 167 respectively. In accordance with the embodiment shown, bottom section 282 of face portion 276 is formed with a pair of clips 298 and 299, each having a corresponding hook 300 (see FIG. 9). In addition, bottom section 282 is provided with a web section 304 which extends substantially perpendicularly from bottom section 282 and preferably interconnects clips 298 and 299.

In accordance with the present embodiment, face portion 276 is placed within bottom portion 51 such that mounting members 209 and 210 and mounting parts 213 and 214 align with corresponding ones of mounting components 159 and 160 and mounting elements 166 and 167. Likewise, clips 298 and 299 must be aligned with notches 264 and 265 formed in inner wall section 250. At this point, face portion 276 is shifted forward such that each of the aforementioned components interengage, causing front surface 285 to be substantially coplanar with front wall 54. At this point, face portion 276 is shifted downward such that mounting members 209 and 210 and mounting parts 213 and 214 respectively nest within mounting components 159 and 160 and mounting elements 166 and 167. In addition, clips 298 and 299 extend through and secure within openings 264 and 265, while web section 304 rides against guide member 267 ensuring that front surface 285 provides a seamless appearance.

In accordance with a still further form of the invention shown in FIG. 11, instead of guide member 267, bottom section 282 of storage bin 37" is provided with a pair of guide blocks 366 and 368 which cooperate with a positioning element 425 formed on bottom section 282 of front face portion 276. Positioning element 425 cooperates with guide blocks 366 and 368 to ensure that front surface 285 and front portion 156 are substantially co-planar providing for a seamless, finished appearance. In any event, it should be recognized that the present invention allows for a simple and robust mounting arrangement for securing a facade or front face portion to a base portion so as to form or establish a multi-piece storage bin for mounting in a refrigerator.

Although described with reference to preferred embodiments of the invention, it should be readily understood that various changes and/or modifications can be made to the invention without departing from the spirit thereof. In general, the invention is only intended to be limited by the scope of the following claims.

We claim:

1. A refrigerator comprising:
 - a cabinet shell;
 - a liner disposed in the cabinet shell that defines at least a fresh food compartment;
 - a door pivotally mounted relative to the cabinet for selectively closing the fresh food compartment, said door including an outer shell and an inner liner; and
 - a storage bin assembly detachably supported on the inner liner of the door, said storage bin assembly including:
 - a base portion having front, bottom, rear and opposing side walls, said front wall including a frontal opening collectively defined by first and second side portions and a bottom portion, each of said first and second side portions including a mounting component and a

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mounting element spaced from the mounting component; said bottom portion being provided with a recess; and

a face portion mounted in the frontal opening such that the face portion is surrounded by the front wall of the base portion, said face portion including top, bottom and opposing side sections, each of said side sections including a mounting member and a mounting part spaced from the mounting member, wherein said bottom section is nested in said recess, said mounting member is interengaged with a respective said mounting component and the mounting part is interengaged with a respective said mounting element to secure the face portion to the base portion.

2. The refrigerator according to claim 1, wherein each of the mounting elements is constituted by a depression formed in a respective one of the first and second side portions of the front wall.

3. The refrigerator according to claim 2, wherein each of the mounting members is constituted by a raised rib.

4. The refrigerator according to claim 3, wherein each of the mounting components is constituted by a slot formed on a respective one of the first and second side portions, with said slot receiving a respective said raised rib.

5. The refrigerator according to claim 4, wherein each of the opposing side sections of the face portion is provided with a respective boss, with said boss being received in a respective said slot for pivotally interconnecting the face portion to the base portion.

6. The refrigerator according to claim 2, wherein each of the mounting parts is constituted by a flange, with said flange being nested in a respective said depression.

7. The refrigerator according to claim 2, wherein the bottom section of the face portion includes a lip, said lip being nested within the recess formed in the bottom portion of the base portion.

8. The refrigerator according to claim 1, wherein each of the mounting elements is constituted by a notch formed in a respective one of the first and second side portions.

9. The refrigerator according to claim 8, wherein each of the mounting components is constituted by a notch formed in the rear surface of a respective one of the first and second side portions.

10. The refrigerator according to claim 8, wherein each of the mounting members is constituted by a finger extending from a respective one of the opposing side sections of the face portion.

11. The refrigerator according to claim 10, wherein each of the mounting parts is constituted by a finger extending from a respective one of the opposing side sections of the face portion.

12. The refrigerator according to claim 8, wherein the bottom portion of the base portion includes inner and outer wall portions, said inner and outer wall portions collectively defining the recess.

13. The refrigerator according to claim 12, further comprising:

at least one aperture opening into the recess; and

at least one clip projecting from the bottom section of the face portion, said clip being formed with a hook extending through the at least one aperture and snap-fittingly engaging the bottom wall of the base portion.

14. A storage bin assembly for an inner liner of a door of a refrigerator comprising:

a base portion having front, bottom, rear and opposing side walls, said front wall having first and second side

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portions and a bottom portion, the portions defining a frontal opening, each of said first and second side portions including a mounting component and a mounting element spaced from the mounting component, said bottom portion being provided with a recess; and

a face portion mounted in the frontal opening such that the face portion is surrounded by the front wall of the base portion, said face portion including top, bottom and opposing side sections, each of said side sections including a mounting member and a mounting part spaced from the mounting member, wherein said bottom section is nested in said recess, said mounting member is interengaged with a respective said mounting component and the mounting part is interengaged with a respective said mounting element to secure the face portion to the base portion,

wherein the storage bin assembly is adapted to be detachably supported on the inner liner of the door.

15. A method of assembling a refrigerator storage bin including a base portion having front, bottom, rear and opposing side walls, the front wall having first and second side portions and a bottom portion, the portions defining a frontal opening, and a face portion including top, bottom and opposing side sections comprising:

engaging a mounting member, located on one of the opposing side sections of the face portion, with a corresponding mounting component provided on a respective one of the side portions of the front wall of the base portion;

positioning a mounting part located on one of the opposing side sections of the face portion spaced from the mounting member with a corresponding mounting element provided on a respective one of the side portions of the front wall of the base portion and spaced from the mounting component; and

snap-fittingly interconnecting the face portion in the frontal opening of the base portion by shifting the face portion relative to the base portion so as to inter-engage both the mounting member with the mounting component and the mounting part with the mounting element, such that the face portion is surrounded by the front wall of the base portion and the bottom section of the face portion extends into a recess provided along the bottom portion upon interconnecting the face portion to the base portion.

16. The method of claim 15, further comprising:

aligning a clip projecting from the bottom section of the face portion with an aperture formed in the bottom portion; and

snap-fittingly engaging a hook member provided on the clip with the bottom wall of the storage bin through the aperture upon shifting of the face portion relative to the base portion.

17. The method of claim 15, further comprising: pivotally interconnecting the face portion to the base portion prior to snap-fittingly interconnecting the face portion in the frontal opening of the base portion.

18. The method of claim 15, wherein the face portion is shifted toward the bottom wall and substantially parallel to the rear wall of the base portion to snap-fittingly interconnect the face portion to the base portion.

19. The method of claim 15, wherein the face portion is shifted toward the front wall of the base portion to snap-fittingly interconnect the face portion to the base portion.

* * * * *

EXHIBIT 14



제품소개

고객서비스

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투자정보

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EXHIBIT 15



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